

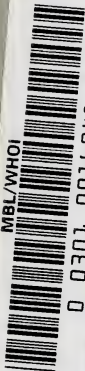
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SCIENTIFIC RESULTS OF THE EXPEDITION TO THE GULF OF CALIFORNIA  
IN CHARGE OF C. H. TOWNSEND, BY THE U. S. FISHERIES STEAMSHIP  
'ALBATROSS' IN 1911. COMMANDER C. H. BURRAGE, U. S. N.,  
COMMANDING.

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V.

*Echinoderms from Lower California, with Descriptions  
of new Species.*

BY HUBERT LYMAN CLARK.

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**Article VIII.—ECHINODERMS FROM LOWER CALIFORNIA,  
WITH DESCRIPTIONS OF NEW SPECIES.<sup>1</sup>**

BY HUBERT LYMAN CLARK.

Museum of Comparative Zoölogy, Cambridge, Mass.

[By permission of the U. S. Commissioner of Fisheries.]

PLATES XLIV TO XLVI.

The collection of echinoderms made by the 'Albatross' Expedition to Lower California in the spring of 1911 proves to be of more than ordinary interest. It consists of 1881 specimens representing 107 species, of which 40 are starfishes, 31 are ophiurans, 18 are echini and 18 are holothurians. There are no crinoids in the collection. There is one apparently new species among the echini and two undescribed forms in each of the other classes. Unfortunately no less than 33 species are represented by only one or two specimens and as these are not infrequently in poor condition and occasionally without a locality label, there are a considerable number of specimens whose identification is dubious.

The region explored by the 'Albatross' is on the boundary between the Panamic region and that of the North Pacific, at least 54 of the species having been previously taken in the Panamic region. Yet there are a considerable number of northern forms, especially among the starfishes. These, however, are as a rule from the more northern stations. So far as littoral forms are concerned the boundary between the two regions appears to be about in the latitude of San Diego. Echinoderms were taken at all of the 'Albatross' dredging stations except three, Nos. 5679, 5680 and 5681. These three stations are in 325-405 fms. off the southern end of Lower California and it seems very strange that no echinoderms whatever were gotten that day, March 22. At about half of the harbors and anchorages visited, littoral echinoderms were gathered. The largest number of species taken at any one spot was 18 at 5694; 28 species were taken in that general

<sup>1</sup> Scientific Results of the Expedition to the Gulf of California in Charge of Dr. C. H. Townsend, by the U. S. Fisheries Steamship 'Albatross' in 1911. Commander G. H. Burrage, U. S. N. Commanding.

region on April 26, stations 5693-5695, 451-640 fms. This locality is southwest of the Santa Barbara Islands, California. Off Monterey County, California, stations 5696-5699, 440-659 fms., 19 species were taken; and off Pt. San Tomas, west coast of Lower California, stations 5673, 5674, 5691, 5692, 590-1090 fms., 17 species were collected. Off Cape St. Lucas, at station 5682, five species were taken while at 5683, in slightly deeper water, five wholly different species were found. These two hauls were however, four weeks apart in time, as the 'Albatross' did no dredging while in the Gulf of California.

The chief interest of the collection lies in the light which it throws on the distribution of previously known species. Little light is thrown on bathymetrical distribution, and the bottom temperatures are surprisingly uniform. Nevertheless, where a species was found at more than three stations, I have given a summary of its bathymetrical and temperature ranges, so far as the present collection shows them. Several of the new forms are of more than ordinary interest. Of the two new starfishes one is a *Zoroaster*, apparently intermediate between the typical members of the genus and Fisher's proposed subgenus *Myxoderma*; the other is a *Pediceaster* remarkable for its large size. Of the ophiurans, one is a representative of the very large cosmopolitan genus *Ophiura*, while the other represents a new generic type, allied to *Ophioderma*, but even more specialized. The new echinoid is one of the perplexing genus *Urechinus*, characteristic deep sea spatangoids. Among the holothurians it is interesting to find a new, well-characterized species of the very diversified genus *Stichopus*, the members of which are at present in a condition of the greatest confusion. Fortunately the three Pacific coast species are not only well set off from the rest of the genus but are readily distinguishable from each other. The other new holothurian seems to represent a new genus, remarkable among the Elasipods for the absence of dorsal appendages of any kind.

Holotypes of the new species are deposited in the United States National Museum. Thanks to the generosity of the American Museum of Natural History, paratypes of five of the seven are in the collections of the Museum of Comparative Zoölogy, while paratypes of the two holothurians are in the American Museum. In this connection I desire to put on record my sincere appreciation of the courtesies shown me by the authorities of the American Museum in connection with the preparation of this report. Particularly I wish to thank Dr. C. H. Townsend and Director F. A. Lucas for entrusting the collection to me for study, and for granting all my requests concerning both the specimens and the report.



## ASTEROIDEA.

**Eremicaster tenebrarius.**

*Porcellanaster (Eremicaster) tenebrarius* FISHER, 1905. Bull. Bur. Fish., Vol. 24, p. 293.

*Eremicaster tenebrarius* LUDWIG, 1907. Zool. Anz., Vol. 31. p. 318.

There is a single specimen of this species in the collection. It has  $R = 25$  mm. and  $r = 8$  mm. Each of the superomarginals carries a conspicuous spine. There is only a single furrow spinelet on each adambulacral plate, but the segmental papillae are conspicuous nearly to the end of the arm. The terminal plate has only three spinelets. There are but ten superomarginal plates. In all these points, this individual resembles Alaskan specimens more closely than it does those from California.

Station 5684. Southwest of Santa Margarita Island, west coast of Lower California, 1760 fms.

**Eremicaster pacificus.**

*Porcellanaster pacificus* LUDWIG, 1905. Mem. M. C. Z., Vol. 32, p. 89.

*Eremicaster pacificus* FISHER, 1907. Zool. Anz., Vol. 32, p. 14.

Both adults and young are represented in this series, the largest having  $R = 24$  and the smallest,  $R = 8$ . As the latter is considerably smaller than any hitherto described, a few details of its structure may be worth recording. There are eight or nine adambulacral plates but only five or six marginals. Most of the superomarginal plates carry a spine and the adambulacra usually have two, but the distal ones may have only one. The terminal plate of each arm carries five spines, of which the median is  $1\frac{1}{2}$  mm. long. The median cribriform organ is made up of eight to ten lamellae but the lateral ones are much less developed and have only four to six lamellae. The madreporite is large and the periproctal tube is  $2\frac{1}{2}$  mm. long.

Station 5673. Off Pt. San Tomas, west coast of Lower California, 1090 fms.

Station 5691. Off Pt. San Tomas, west coast of Lower California, 868 fms. Bottom Temp.,  $37.2^{\circ}$ .

Station 5692. Off Pt. San Tomas, west coast of Lower California, 1076 fms. Bottom Temp.,  $37.1^{\circ}$ .

Eleven specimens.

**Ctenodiscus crispatus.**

*Asterias crispatus* RETZIUS 1805. Diss. sp. cog. Ast., p. 17.

*Ctenodiscus crispatus* DUBEN and KOREN, 1846. K. vet. Akad. Handl. f. 1844, p. 253.

A single small specimen (R = 15 mm.) is all the collection contains of this common and widespread species.

Station 5686. Off Ballenas Bay, west coast of Lower California, 930 fms. Bottom Temp., 37.3°.

**Leptychaster inermis.**

*Parastropecten inermis* LUDWIG, 1905. Mem. M. C. Z., Vol. 32, p. 76.

*Leptychaster inermis* FISHER, 1911. Bull. U. S. Nat. Mus., No. 76, p. 53.

The two specimens are both small, the larger being about the same size as the larger of Ludwig's types (R = 18 mm.). They seem however, to belong to the Panamic species rather than to the more northern *anomalus* for there are six or seven furrow spines on each adambulacral plate and only four papulae around each paxilla-base. The larger specimen answers well to Ludwig's description and photographs except that the rays are relatively a little shorter. The geographical range of the species is extended far northward by its occurrence off California.

Station 5685. Southwest from Ballenas Bay, west coast of Lower California, 645 fms.

Station 5699. Southwest from Monterey Bay, California, 659 fms. Bottom Temp., 37.9°.

**Astropecten erinaceus.**

Gray, 1840. Ann. Mag. Nat. Hist., Vol. 6, p. 182.

The status of the *Astropectens* of the Pacific coast of America which have spines on the superomarginal plates is still uncertain and probably must remain so until satisfactory collections can be made on the coast of Ecuador, preferably at Punta Santa Elena, whence Gray's types came. Fisher follows Perrier in considering *erinaceus* and *armatus* identical but I am not prepared to admit this as it seems to me more likely that *armatus* is the species described by Verrill under the name *peruviana*. At the same

time it is quite possible that all of these nominal species are really one. For the present, I think it desirable to retain the names *erinaceus* and *peruvianus* to distinguish the two forms now recognized, the former with spines on the outer edge of marginal plates at middle of arm and the series double, if anywhere, at base of arm; while the latter has the spines on the inner edge of the plates and the series double, if anywhere, near tip of arm.

The specimens in the present collection show interesting geographical diversity. The specimens from Ballenas Bay and San Bartolomé have relatively broad arms, inconspicuous superomarginal spines in incomplete series, central granules of paxillæ noticeably enlarged and the stout actinal spine on each adambulacral plate short and truncate;  $R = 85$ ,  $r = 17$  and  $br = 18$  mm. or  $R = 62$ ,  $r = 18$  and  $br = 17$  mm. So  $R = 3.5-5 r$  or  $br$ . The color of these more northern specimens is light yellowish-brown. The individuals from Cape St. Lucas are smaller, ranging from  $R = 8$  to  $R = 55$  mm. The latter has  $r$  and  $br$  scarcely more than 10 mm. so that the rays appear longer and narrower than in the more northern specimens. The color is also different; brown with a tinge of purple. The superomarginal spines are conspicuous and the series are quite complete, being double near the bases of the arms, but not in the arm-angles. The central granules of the paxillæ are not enlarged and the big actinal spine on each adambulacral plate is quite long and rounded at tip. These specimens from Cape St. Lucas approach those in the M. C. Z. collection from Peru, but the latter have the actinal spines on the adambulacral plates still longer and more pointed and the spinelets of the paxillæ are not at all graniform. In these particulars the difference between southern (Peru) and northern (California) specimens is very marked but the Cape St. Lucas specimens are intermediate.

San Bartolomé, west coast of Lower California.

Ballenas Bay, west coast of Lower California.

Cape St. Lucas, Lower California.

Eight specimens.

### **Psilaster pectinatus.**

*Bathybiaster pectinatus* FISHER, 1905. Bull. Bur. Fish., Vol. 24, p. 295.

*Psilaster pectinatus* FISHER, 1911. Bull. U. S. Nat. Mus., No. 76, p. 72.

Both of the specimens before me are young ( $R = 13$  and  $R = 35$  mm.) and show no characters worthy of mention.

Station 5692. Off Pt. San Tomas, west coast of Lower California, 1076 fms. Bottom Temp.,  $37.1^{\circ}$ .

**Thrissacanthias penicillatus.**

*Persephonaster penicillatus* FISHER, 1905. Bull. Bur. Fish., Vol. 24, p. 297.

*Thrissacanthias penicillatus* FISHER, 1910. Ann. Mag. Nat. Hist., (8) Vol. 5, p. 171.

While most of the specimens in this series are large adults, there are three specimens in which R is only about 25 mm. At first sight these were thought to represent another species but careful comparison with adults reveals nothing distinctive. The rays are relatively shorter and wider and the marginal spines and paxillæ spinelets are less conspicuous. The color is lighter, being nearly white. In none of the specimens examined, either large or small, have I been able to find any pedicellariæ, but probably further search would have revealed some. No specimens of this species were taken south of San Pedro, Cala.

Station 5694. Southwest of Santa Cruz Island, California, 640 fms.

Station 5695. Southwest of Santa Rosa Island, California, 534 fms. Bottom Temp., 38.9°.

Station 5696. Off San Luis Obispo County, California, 440 fms. Bottom Temp., 39.9°.

Station 5697. Off Monterey County, California, 485 fms. Bottom Temp., 39.8°.

Station 5698. Off Monterey County, California, 475 fms. Bottom Temp., 39.9°.

Station 5699. Southwest from Monterey Bay, California, 659 fms. Bottom Temp., 37.9°.

Bathymetrical range, 440-659 fms. Temperature range, 39.9°-37.9°.

Twenty-six specimens.

**Luidia phragma.**

H. L. Clark, 1910. Bull. M. C. Z., Vol. 52, p. 329.

There is a good series of this species, although none are very large. In the largest, R = 60 mm. The series of spinelets along each side of the ray, abactinally, is generally well developed, but may be incomplete and in one specimen extends scarcely half the length of the ray.

South end of Magdalena Bay, Lower California. Thirteen specimens.

**Pectinaster agassizii.**

*Cheiraster agassizii* LUDWIG, 1905. Mem. M. C. Z., Vol. 32, p. 1.

*Pectinaster agassizii* LUDWIG, 1910. Sitz. K. Preuss. Akad. Wiss., Vol. 23, p. 449.

These specimens appear to be typical *agassizii* as they have few papulae in each papularium and no abactinal or marginal pedicellariae, while actinally pedicellariae are very common. Even the specimens from Station 5693, which are in very poor condition, seem to be no nearer the subspecies *evoplus*. The range of typical *agassizii* is thus extended considerably northward.

Station 5673. Off Pt. San Tomas, west coast of Lower California, 1090 fms.

Station 5674. Off Pt. San Tomas, west coast of Lower California, 590 fms. Bottom Temp., 39.4°.

Station 5686. Off Ballenas Bay, west coast of Lower California, 930 fms. Bottom Temp., 37.3°.

Station 5689. Off Rosario Bay, west coast of Lower California, 879 fms.

Station 5690. Off Rosario Bay, west coast of Lower California, 1101 fms. Bottom Temp., 38.1°.

Station 5692. Off Pt. San Tomas, west coast of Lower California, 1076 fms. Bottom Temp., 37.1°.

Station 5693. Northwest of San Nicolas Island, California, 451 fms.

Bathymetrical range, 451-1101 fms. Temperature range, 39.4°-37.1°.

Ninety-six specimens; one perfectly tetramerous.

**Nearchaster aciculosus.**

*Acantharchaster aciculosus* FISHER, 1910. Zool. Anz., Vol. 35, p. 550.

*Nearchaster aciculosus* FISHER, 1911. Ann. Mag. Nat. Hist. (8), Vol. 7, p. 92.

The specimens in which R exceeds 100 mm. have actinal intermediate pedicellariae present and there are also a very few inferomarginal pedicellariae to be seen. But the smaller specimens do not have actinal pedicellariae anywhere. It seems probable that this difference if it is anything more than individual diversity, is due to age and not, as Fisher suggests, to locality. The largest specimen in this collection has R in excess of 160 mm. but the tips of all the arms are missing.

Station 5688. Off Cedros Island, west coast of Lower California, 525 fms. Bottom Temp., 39.9°.

Station 5694. Southwest of Santa Cruz Island, California, 640 fms.

Station 5695. Southwest of Santa Rosa Island, California, 534 fms.

Bottom Temp., 38.9°.

Station 5698. Off Monterey County, California, 475 fms. Bottom Temp., 39.9°.

Bathymetrical range, 525–640 fms. Temperature range, 39.9°–38.9°.

Twenty-three specimens.

### ***Pseudarchaster pectinifer.***

Ludwig, 1905. Mem. M. C. Z., Vol 32, p. 106.

It is only after the greatest hesitation that I call the largest *Pseudarchaster* in the collection by the name of the Panamic species. I certainly should not do so if Fisher had not suggested the possibility that the northern species *dissonus* intergrades with *pectinifer*. As the present specimen entirely lacks the characteristic pedicellariæ of *dissonus* and shows other, slight differences, I cannot consider it that species. On the other hand the adambulacral armature is utterly different from that of *pectinifer* as described by Ludwig. But the latter only had a single specimen, much smaller than mine, in which  $R = 140$  mm., and perhaps with more material the differences might sink into insignificance. In the specimen before me the aboral portion of the margin of each adambulacral plate is much longer than the adoral until near the tip of the arm; or, in other words the angle of each plate which projects into the furrow and separates adjoining tube-feet is much nearer the oral end of the plate than it is the aboral. Ludwig says the opposite condition occurs in *pectinifer*. In the present specimen, there are only four or five furrow-spines on each plate, one on the adoral side, one (the largest) on the point of the angle, and two or three on the aboral side; on the actinal surface of the plate are eight to twelve somewhat smaller spines, well-spaced and only indistinctly in rows. Ludwig says there are eight or nine furrow spines and four to seven on the surface of the plate. In my specimen there are eleven or twelve adambulacral plates to ten inferomarginals, while Ludwig says that in *pectinifer* there are only nine.—In view of these differences, I think it possible that the specimen before me represents an undescribed species but more material must be examined before the question can be settled.

Station 5676. Off San Juanico, west coast of Lower California, 647 fms. Bottom Temp., 39°.

**Pseudarchaster pusillus.**

Fisher, 1905. Bull. Bur. Fish., Vol. 24, p. 304.

There is a very good series of this species, ranging from  $R = 14$  mm. to  $R = 40$  mm. They show very little variation among themselves but the paxillæ spinelets and the spines of the marginal plates and actinal surface are all so slender and so well spaced that the general facies is different from typical *pusillus* and at the opposite extreme from the form described and figured by Fisher from off San Diego, 'Albatross' St. 4367. But there is little reason to doubt the identity of the specimens for they do not approach the Panamic forms described by Ludwig.

Station 5675. Southwest of San Cristobal Bay, west coast of Lower California, 284 fms. Bottom Temp.,  $44.6^{\circ}$ . Thirty specimens.

**Ceramaster leptoceramus.**

*Tosia leptoceramus* FISHER, 1905. Bull. Bur. Fish., Vol. 24, p. 306.

*Ceramaster leptoceramus* FISHER, 1911. Bull. U. S. Nat. Mus., No. 76, p. 210.

Neither of the two specimens before me is adult. In the larger  $R = 35$  mm.; in the smaller  $R = 26$  mm. Few of the adambulacral plates in either specimen have more than six furrow spines. The range of the species is extended southward some distance, by its occurrence at the following station.

Station 5675. Southwest of San Cristobal Bay, west coast of Lower California, 284 fms. Bottom Temp.,  $44.6^{\circ}$ . Two specimens.

**Ceramaster patagonicus.**

*Pentagonaster patagonicus* SLADEN, 1889. 'Challenger' Asteroids, p. 269.

*Ceramaster patagonicus* FISHER, 1911. Bull. U. S. Nat. Mus., No. 76, p. 214.

A pentagonal starfish with conspicuous marginal plates and having  $R = 30$  mm. seems to belong to this species as described and figured by Fisher. I am inclined to think that more abundant material will show that the north Pacific specimens are not conspecific with *patagonicus*.

Station 5682. Off Cape St. Lucas, Lower California, 491 fms. Bottom Temp.,  $40.8^{\circ}$ .

**Hippasteria californica.**

Fisher, 1905. Bull. Bur. Fish., Vol. 24, p. 310.

A specimen with  $R = 130$  mm. represents this species.

Station 5694. Southwest of Santa Cruz Island, California, 640 fms.

**Hippasteria spinosa.**

Verrill, 1909. Amer. Jour. Sci., Vol. 28, p. 63.

A specimen with  $R$  only 9 mm. seems to be undoubtedly the young of this species, although it was taken at a considerably greater depth than has been hitherto known for *spinosa*. There are only four marginal plates in each series. These carry conspicuous thick spines; if there are two or three on a plate, one (the median of three) is notably larger than the others. The abactinal plates are each bordered with spiniform granules from four to twelve in number according to the size of the plate. The primary plates are conspicuous and each carries a central spinelet. Actinally the furrow and subambulacral spines are conspicuous, but the spiniform granules of the actinal intermediate plates are very small. No pedicellariæ are to be seen anywhere actinally but five or six on the abactinal surface are very conspicuous; there are none on the marginal plates.

Station 5693. Northwest of San Nicolas Island, California, 451 fms.

**Oreaster occidentalis.**

Verrill, 1866. Trans. Conn. Acad., Vol. 1, p. 373.

There are two small specimens from Agua Verde Bay, east coast of Lower California. The larger has  $R = 80$  mm.

**Amphiaster insignis.**

Verrill, 1868. Trans. Conn. Acad., Vol. 1, p. 373.

A fine specimen ( $R = 80$  mm.) from Magdalena Bay, west coast of Lower California, is the only representative of this remarkable starfish.

**Linckia columbiæ.**

Gray, 1840. Ann. Mag. Nat. Hist., Vol. 6, p. 285.

This species is represented by a young individual from San Josef Island, Gulf of California, and four small adults from San Francisquito Bay, east coast of Lower California. The largest specimen has  $R = 82$  mm.



**Phataria unifascialis.**

*Linckia* (*Phataria*) *unifascialis* GRAY, 1840. Ann. Mag. Nat. Hist., Vol. 6, p. 285.

*Phataria unifascialis* SLADEN, 1889. 'Challenger' Asteroids, p. 786.

Of this common and characteristic west Mexican species, there are three small specimens from Pichilingue Bay, east coast of Lower California. The largest has R about 70 mm.

**Echinaster tenuispinus.**

Verrill, 1871. Trans. Conn. Acad., Vol. 1, p. 577.

These specimens call for no special comment. The largest has R = 50 mm.; in the smallest R = 18 mm.

San Bartolomé, west coast of Lower California.

Agua Verde Bay, east coast of Lower California.

San Francisquito Bay, east coast of Lower California.

San Esteban Island, Gulf of California.

Five specimens.

**Henricia clarki.**

Fisher, 1910. Zool. Anz., Vol. 35, p. 573.

There is a single individual in the collection, which seems to belong to this species. In it R = about 75 mm. On only a few of the proximal adambulacral plates are there as many as three spinelets in the furrow, and in a few other details the specimen is not typical but in view of the locality and depth, there can be little doubt of its belonging to this species.

Station 5682. Off Cape St. Lucas, Lower California, 491 fms. Bottom Temp., 40.8°.

**Henricia læviuscula annectens.**

Fisher, 1910. Zool. Anz., Vol. 35, p. 572.

Two small *Henricias*, with R about 20 mm. seem to represent this form. San Bartolomé, west coast of Lower California.

Station 5693. Northwest of San Nicolas Island, California, 451 fms.

**Solaster paxillatus.**

Sladen, 1889. 'Challenger' Asteroidea, p. 452.

Each of the three specimens has eight arms. In the smallest,  $R = 37$  mm. In one of the large ones  $R = 135$  and the ray is 35 mm. broad at the disk-margin, while in the other large specimen, with the rays about equally long, br is only 23 mm. These two large specimens have no locality label but there is reason to think they came from Station 5694, southwest of Santa Cruz Island, California, 640 fms. The small specimen is from Station 5695, southwest of Santa Rosa Island, California, 534 fms.; bottom Temp.,  $38.9^{\circ}$ . The occurrence of this Japanese species, so far south on the American coast, is noteworthy, but I can find no good reason for refusing to refer these specimens to that species.

**Solaster borealis.**

*Crossaster borealis* FISHER, 1906, Proc. Wash. Acad. Sci., Vol. 8, p. 134.

*Solaster borealis* FISHER, 1911. Bull. U. S. Nat. Mus., No. 76, p. 320.

One of these specimens has only *ten* rays but each of the others has *eleven*. The largest specimen has  $R = 135$  mm. while the smallest has  $R$  only 20 mm.

Station 5694. Southwest of Santa Cruz Island, California, 640 fms.

Station 5696. Off San Luis Obispo County, California, 440 fms. Bottom Temp.,  $39.9^{\circ}$ .

Station 5698. Off Monterey County, California, 475 fms. Bottom Temp.,  $39.9^{\circ}$ .

Station 5699. Southwest from Monterey Bay, California, 659 fms. Bottom Temp.,  $37.9^{\circ}$ .

Bathymetrical range, 440–659 fms. Temperature range,  $39.9^{\circ}$ – $37.9^{\circ}$ .

Ten specimens.

**Heterozonias alternatus.**

*Crossaster alternatus* FISHER, 1906. Proc. Wash. Acad. Sci., Vol. 8, p. 131.

*Heterozonias alternatus* FISHER, 1910. Ann. Mag. Nat. Hist. (8), Vol. 5, p. 172.

There is a fine series of this interesting starfish, of which one has *nine* rays, 26 have *ten* rays and one has *eleven*. The largest specimen has  $R = 160$  mm. while in the smallest  $R$  is only about 13 mm.

Station 5694. Southwest of Santa Cruz Island, California, 640 fms.

Station 5697. Off Monterey County, California, 485 fms. Bottom Temp., 39.8°.

Station 5698. Off Monterey County, California, 475 fms. Bottom Temp., 39.9°.

Station 5699. Southwest from Monterey Bay, California, 659 fms. Bottom Temp., 37.9°.

Bathymetrical range, 475-659 fms. Temperature range, 39.9°-37.9°. Twenty-eight specimens.

### **Lophaster furcilliger.**

Fisher, 1905. Bull. Bur. Fish., Vol. 24, p. 312.

These specimens are all typical *furcilliger*, as would naturally be expected in view of the depth at which they were taken. The smallest has  $R = 20$  mm. In the largest  $R = 60$  mm.

Station 5694. Southwest of Santa Cruz Island, California, 640 fms.

Station 5695. Southwest of Santa Rosa Island, California, 534 fms. Bottom Temp., 38.9°.

Station 5699. Southwest from Monterey Bay, California, 659 fms. Bottom Temp., 37.9°.

Twelve specimens.

### **Peribolaster biserialis.**

Fisher, 1905. Bull. Bur. Fish., Vol. 24, p. 313.

In these specimens  $R$  ranges from 10 to 17 mm. but there is nothing noteworthy about them.

Station 5696. Off San Luis Obispo County, California, 440 fms. Bottom Temp., 39.9°.

Four specimens.

### **Pteraster jordani.**

Fisher, 1905. Bull. Bur. Fish., Vol. 24, p. 314.

A single specimen with  $R = 70$  mm. is in the collection.

Station 5695. Southwest of Santa Rosa Island, California, 534 fms. Bottom Temp., 38.9°.

**Hymenaster perissonotus.**

Fisher, 1910. Ann. Mag. Nat. Hist. (8), Vol. 5, p. 170.

Although only the smallest individual is well preserved, there is little doubt as to the identity of these specimens. There are only four oral spines on a plate, as a rule, and there is thus an approach to *gracilis* in this particular, but occasionally there are five and very rarely six such spines. The largest specimen has  $R = 40$  mm.; in the smallest, it is about 30.

Station 5689. Off Rosario Bay, west coast of Lower California, 879 fms.

Station 5691. Off Pt. San Tomas, west coast of Lower California, 868 fms. Bottom Temp.,  $37.2^{\circ}$ .

Four specimens.

**Hymenaster quadrispinosus.**

Fisher, 1905. Bull. Bur. Fish., Vol. 24, p. 315.

These specimens are poorly preserved but show the characteristics of the species fairly well.  $R$  ranges from about 37 to nearly 60 mm.

Station 5690. Off Rosario Bay, west coast of Lower California, 1101 fms. Bottom Temp.,  $38.1^{\circ}$ . Four specimens.

**Zoroaster evermanni.**

Fisher, 1905. Bull. Bur. Fish., Vol. 24, p. 317.

There is an excellent series of this interesting species, which seems to be common all along the coast of California between Monterey and San Diego, in four to seven hundred fathoms. The largest specimens ( $R = 220$  mm.) are much larger than Fisher's type, and the coarseness of the reticulation of the abactinal skeleton is very marked. But there is only a single series of abactinal plates between the radial series and the superomarginals and even at the extreme base of the ray, there are but three series of actino-lateral plates. In the smallest specimen ( $R = 70$  mm.), the third series of these plates is to be found only just indicated by two or three plates.

Station 5694. Southwest of Santa Cruz Island, California, 640 fms.

Station 5695. Southwest of Santa Rosa Island, California, 534 fms. Bottom Temp.,  $38.9^{\circ}$ .

Station 5696. Off San Luis Obispo County, California, 440 fms. Bottom Temp.,  $39.9^{\circ}$ .

Station 5697. Off Monterey County, California, 485 fms. Bottom Temp., 39.8°.

Station 5698. Off Monterey County, California, 475 fms. Bottom Temp., 39.9°.

Station 5699. Southwest from Monterey Bay, California, 659 fms. Bottom Temp., 37.9°.

Bathymetrical range, 440-659 fms. Temperature range, 39.9°-37.9°.

Nineteen specimens.

### **Zoroaster ophiurus.**

Fisher, 1905. Bull. Bur. Fish., Vol. 24, p. 315.

This seems to be a more southern species than the preceding, occurring along the coast of Lower California in eight to eleven hundred fathoms. The specimens before me range from  $R = 25$  mm. to  $R = 160$  mm., The latter are thus larger than the type. In the small specimens, the spines on the primary plates of the disk and on the radial series of each ray are very conspicuous, 1-2 mm. long. In half grown specimens they are apparently no larger and hence are no longer conspicuous. In the little specimens, there are only two or three series of actino-lateral plates at the base of the ray.

Station 5686. Off Ballenas Bay, west coast of Lower California, 930 fms. Bottom Temp., 37.3°.

Station 5689. Off Rosario Bay, west coast of Lower California, 879 fms.

Station 5690. Off Rosario Bay, west coast of Lower California, 1101 fms. Bottom Temp., 38.1°.

Six specimens.

### **Zoroaster platyacanthus**<sup>1</sup> sp. nov.

Plate XLIV, Figs. 1 and 2.

Rays 5.  $R = 67$  mm.;  $r = 9\frac{1}{2}$  mm.  $R = 7r$ . Breadth of ray at base, 10 mm.

Disk rather convex (concave at center in type); rays moderately long, more or less flattened not attenuate; median radial ridge not prominent; spines and spine-lets not very numerous, rather stout, rough-tipped; abactinal pedicellariæ not very conspicuous.

Abactinal skeleton rather heavy; primary plates of disk not specially conspicu-

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<sup>1</sup>  $\pi\lambda\alpha\tau\acute{\upsilon}\varsigma$  = flat wide +  $\acute{\alpha}\kappa\alpha\nu\theta\alpha$  = prickle, spine.

ous and median radial series on arms not much larger than superomarginals; all of the larger plates carry spines and scattered well-spaced spinelets; on each plate there is a central spine, 1-2 mm. long, stout and more or less blunt, and there may be also two or three smaller spines, but the latter are not very constant in number or position; pedicellariæ occur on most of the plates, but the largest of them are much smaller than the central spine.

Between the median radial series of plates on each ray and the superomarginals there is only an incomplete series of small plates, and these are found only at the very base of the ray; the superomarginals are nearly as large as the median plates and the inferomarginals are little smaller; between the latter and the adambulacrals are three series of actinolateral plates, the uppermost of which are nearly as large as the inferomarginals and the lowermost are much smaller, nearly quadrilateral and about three times as long as high. Each marginal and actinolateral plate carries a central spine, and a few small spines or spinelets, well-spaced and mingled with pedicellariæ; the spines on the superomarginals are like those on the median series; those on the inferomarginals are imperceptibly longer; those on the uppermost actinolaterals are longer and slightly flattened near the tip; those on the second series of actinolaterals are the longest (3-4 mm.) and are very wide and flat; those on the lowest actinolaterals are a little shorter, somewhat more slender and are less flattened. All three series of actinolateral plates are continued nearly if not quite to the tip of the ray.

Between the lower series of actinolateral plates, there are no papular areas, but between the upper and second series, the areas are as large as abactinally. Between the median and the superomarginal plates the papular areas are arranged in a double, alternating series. Elsewhere these areas are in single longitudinal series. There is only one papula to each area, and while it is large, it does not occupy all of the area, by any means.

The adambulacral plates are arranged as usual in the genus, plates projecting into the furrow alternating with those which do not. The plates are separated from each other by distinct, membranous spaces; each plate is about three times as wide as long. On the projecting plates is a single series of four or five slender spines, the first of which is well up in the furrow; the second and third are about on the rounded angle of the plate, and the fourth (and fifth, when present) are on the actinal surface; the fourth spine (or fifth) is the smallest and more or less distinctly sacculate at tip; the second and third spines are of about equal size (2 mm.  $\pm$ ) or the third is largest. On the non-projecting plates are two or three spines, of which the first is largest and about equals the third spine of the alternating plates; the other spine (or spines) is slightly sacculate at tip. Pedicellariæ are not specially abundant; each furrow spine may carry one to three but many have none; in the inter-radial angles are a very few pedicellariæ larger than elsewhere, and these may be 2 mm. long. Oral plates very short (as usual in *Zoroaster*), each with two marginal and two suboral spines, 1-2 mm. long; the distal marginal spine carries a cluster of three or four small pedicellariæ.

Tube-feet in four distinct series. Madreporite smaller than a primary disk-plate, situated about half-way between center of disk and margin. Terminal plate of ray moderately large, with two spinelets at the tip and numerous much smaller ones crowded over its surface. Color completely lost in the preserved specimens which are dingy brownish-yellow.

Type.—Cat. No. —, U. S. N. M. from Station 5675 (not yet catalogued).

In the presence of only three series of actinal intermediate plates and in its small median, radial plates, this species resembles *Myxoderma*, a subgenus suggested by Fisher. But the spinelets are not sacculate, not at least to any notable degree, and there is only one papula to each area. This combination of characters taken with the long flat spines along the sides of the ray, actinally, serve to distinguish the species from any *Zoroaster* hitherto described. It is difficult to decide whether the flattened appearance of the rays is natural or artificial, but it is quite marked in both specimens. Possibly these specimens are not adult and spinelets and pedicellariæ would both be more abundant with age.

Station 5675. Southwest of San Cristobal Bay, west coast of Lower California, 284 fms. Bottom Temp., 44.6°.

Two specimens.

### **Heliaster kubiniji.**

Xantus, 1860. Proc. Philadelphia Acad. Nat. Sci., p. 568.

All but one of these specimens is adult. Ten have 23 rays, three have 22 and one has 24. The largest has  $R = 70$  mm.

Pichilingue Bay, east coast of Lower California.

Ricason Island, Conception Bay, east coast of Lower California.

Fourteen specimens.

### **Pedicellaster hyperoncus**<sup>1</sup> sp. nov.

Plate XLIV, Figs. 3 and 4.

Rays 5.  $R = 68$  mm.;  $r = 7$  mm.  $R = 9\frac{1}{2} r$ . Breadth of ray at base, 7 mm. Breadth of ray, 10 mm. from base, 11 mm. Breadth of ray, 10 mm. from tip, 7 mm.

Disk small, flat; rays rather long, decidedly constricted at base and correspondingly swollen just beyond, not attenuate, bluntly pointed; median radial ridge not prominent; spines not numerous, rather small; pedicellariæ abundant. Papular areas on rays with 2-5 papulae. Adambulacral plates numerous with only *one* spine but often with a large pedicellaria also. Tube-feet in two well-defined rows.

Abactinal skeleton fairly heavy on disk, but very open and rather delicate on rays. None of the primary plates are easily recognizable on disk. All of the disk plates carry spines, none of which are conspicuous, but the one near center of plate is the largest. On the rays, the plates usually carry only a single spine each. All the abactinal plates carry numerous small forcipiform pedicellariæ; they occur actinally as far as the inferomarginal plates, each of which carries one or two.

<sup>1</sup> ὑπέρρογος = overgrown, of excessive size.



Between the median radial series of plates and the superomarginals there is only a single, somewhat irregular series of abactinal plates. There are here and there indications of a second series but they are very scattered. The inferomarginals are widely separated from the superior series but adjoin the adambulacra very closely, as there are no intermediate plates whatever. As a result of the widely reticular skeleton, the papular areas on the rays are large and conspicuous. On the disk they are small or moderate, each with one, or rarely two papulae. On the rays, each papular area is wider (or higher) than long and contains 2-5 papulae; these are usually arranged in a vertical series but are occasionally more scattered. The area may also contain an isolated calcareous plate or may be more or less bisected by a calcareous projection from one of its boundary plates. The areas between the two series of marginal plates are about  $2\frac{1}{2}$  mm. high by one millimeter long and generally contain three (or two) papulae.

The adambulacral plates are very numerous, about twenty to an octet of inferomarginals; they are small, the width about equal to the length and about two thirds of the height. Each plate carries one spine, 1.5 mm. long; in addition many plates have, usually on the inner margin, a large forciform pedicellaria almost a millimeter high. Each inferomarginal plate carries, close to the adambulacral series, a spine 2 mm. long; these are the stoutest spines found on the animal. They are distinctly rough under a lens, more so than any of the other spines. Oral plates short; each carries two, or less commonly three, spines a trifle longer than those on the adambulacral plates; generally two large forciform pedicellariae are also present.

Tube-feet large, in two well-marked series. Madreporite small, little more than a millimeter across, close to margin of disk. Color completely lost; the preserved specimen is the usual dingy brownish-yellow, approaching white.

Type.—Cat. No. —, U. S. N. M., from Station 5675.

Although this species resembles the following in form and size, it is distinguishable at once by the more numerous papulae and the characteristic adambulacral armature. The forciform pedicellariae are also larger and much more numerous. The large size marks this species, in comparison with other members of the genus, for except the Indian species *atratus* Alcock, which doubtless deserves separate generic rank, and the Panamic species *improvisus* Ludwig, with which it was taken, it is the giant of the genus. None of the Arctic, Atlantic or Antarctic species of the genus are half as large.

Station 5675. Southwest of San Cristobal Bay, west coast of Lower California, 284 fms. Bottom Temp., 44.6°. One specimen.

### **Pedicellaster improvisus.**

Ludwig, 1905. Mem. M. C. Z., Vol. 32, p. 216.

The specimen representing this species was taken with the one just described, and as it is in very poor condition, it was at first supposed to be



that form. Examination however revealed the interesting fact that it is really the adult of *improvisus*, and is nearly twice as large as Ludwig's biggest specimen.  $R = 80$  mm.,  $r = 10$  mm.,  $R = 8r$ . The double series of adambulacral spines and the single papula in each area distinguish the species, and are well shown by this specimen, although it is discolored, badly distorted and shows the effect of an acid reagent of some sort.

It is certainly an extraordinary fact that the 'Albatross' should have taken two specimens of *Pedicellaster* at Station 5675, representing perfectly distinct species, and then not met with a specimen of the genus elsewhere on her cruise. But I find it impossible to consider the two specimens from Station 5675 conspecific and the only other alternative is the "extraordinary fact" just stated.

### ***Pisaster ochraceus.***

*Asterias ochracea* BRANDT, 1835. Prod. desc. Anim., p. 269.

*Pisaster ochraceus* FISHER, 1908. Smiths. Misc. Coll., Vol. 52, p. 89.

Three good specimens, with  $R$  about 125 mm., represent this species but as there is no locality label, we can only assume they were collected at San Diego or some point still further south. The species has not yet been recorded from Lower California.

### ***Asterias forreri.***

De Loriol, 1887. Rec. Zool. Suisse, Vol. 4, p. 401.

In deference to the opinion of my good friend and highly respected authority on starfishes, Dr. W. K. Fisher, I have been strongly inclined to record these specimens, the largest of which has  $R$  only about 48 mm., as *Asterias sertulifera* Xantus. But as I am unable to understand how they can belong to that species, I have finally decided to let matters stand as they are. When Professor H. S. Jennings was about to publish his most interesting and important paper on the behavior of *Asterias*, he did me the honor of asking me to identify the species with which his work was done, and specimens were sent me from La Jolla, California. It was soon evident that the species was either *sertulifera* Xantus or *forreri* de Loriol. As the former is described as having the rays only  $2\frac{1}{4}$  times the diameter of the disk, the wreaths of pedicellariæ near the tips of the spines, no pedicellariæ scattered among the spines and only a single series of adambulacral spines, while *forreri* has the rays 4 times the diameter of the disk, the wreaths of pedicellariæ near the bases of the spines, numerous scattered pedicellariæ

and a double series of adambulacral spines, I was satisfied that the La Jolla specimens, which showed clearly the latter group of characters, were *forreri*. Accordingly Dr. Jennings's paper was entitled "Behavior of the Starfish, *Asterias forreri* de Lorient." Recently there has appeared the first report of the Laguna Marine Laboratory of Pomona College. On page 89 "*Coscinasterias sertulifera*" is listed and Dr. Fisher is quoted as authority for the statement: "This is the species (under the name *Asterias ferrerii*) upon which Prof. H. S. Jennings carried on a number of experiments at La Jolla. It is a member of the southern fauna, the type locality being Cape San Lucas. The true *Coscinasterias ferrerii* belongs to the northern fauna and is not found along shore." (Of course, Dr. Fisher is not responsible for the misspelling of *forreri*). In correspondence Dr. Fisher has confirmed this statement and says further that *sertulifera* may have a double series of adambulacral spines. If this is so, I am puzzled to see what essential difference there is between the two species. In the M. C. Z. collection there is a large specimen of *forreri* from the type locality, Santa Cruz, on Monterey Bay, California. There are also two specimens from Monterey, identified and labelled by Dr. Fisher as *forreri*. Then there are specimens from La Jolla and from Lower California, which I have called *forreri*. On going over this material again and comparing it with the specimens in the 'Albatross' collection now before me, I am unable to see what the specific differences are. I have never seen an authentic specimen of *sertulifera* but to judge from Xantus' description, it ought to be quite different from *forreri*. It may be that specimens of *forreri* from deep water are distinguishably different from the shore specimens, like those from La Jolla, which I have called *forreri*. However, in view of the present confusion existing in the American Pacific coast species of *Asterias*, I think it best to present this case as I have and leave the matter with Dr. Fisher for ultimate decision.

San Francisquito Bay, east coast of Lower California. Fourteen specimens.

### ***Brisinga panamensis.***

Ludwig, 1905. Mem. M. C. Z., Vol. 32, p. 258.

All of the specimens are badly damaged and only one has any arms still attached to the disk. They show considerable diversity in some details but on the whole, it seems probable they all represent the Panamic species. The largest has the disk 24 mm. across; in the smallest it is 11. Only the largest specimen has 9 rays; all the others have 8. Among Ludwig's specimens only one had 8; all the others had 9.

Station 5673. Off Pt. San Tomas, west coast of Lower California, 1090 fms.

Station 5690. Off Rosario Bay, west coast of Lower California, 1101 fms. Bottom Temp., 38.1°.

Station 5691. Off Pt. San Tomas, west coast of Lower California, 868 fms. Bottom Temp., 37.2°.

Six specimens.

## OPHIUROIDEA.

### *Ophioderma panamensis.*

Lütken, 1859. Add. ad Hist., pt. 2, p. 91.

This species is evidently common in the Gulf of California, as a large series was brought home by the 'Albatross.' The largest are about twenty millimeters across the disk. Young individuals have the arms quite distinctly banded, but in large specimens, the bands seem to be confined to the tips of the arms.

Pichilingue Bay, east coast of Lower California.

San Francisquito Bay, east coast of Lower California.

Sixty-one specimens.

### *Ophioderma variegata.*

Lütken, 1856. Vid. Med., p. 21.

The most highly colored animal in the whole collection is one of the representatives of this tropical species. The disk is bright green, the arms are banded with green and grayish-green, and the base of each arm with the adjoining portion of the disk is bright rose-red. In two specimens, the disk is dull yellowish-brown. The largest individual is 10 mm. across the disk. McClendon (1909, Univ. Cal. Publ. Zool., Vol. 6, no. 3) does not include this species in his list of ophiurans from the San Diego region and it is quite possible that it does not occur on the west coast of Lower California.

"Lower California."

Agua Verde Bay, east coast of Lower California.

Four specimens.

**Diopederma**<sup>1</sup> gen. nov.

Disk very flat; arms flattened, especially at base, where they are twice as wide as at middle. Disk more or less completely covered with granules. Oral papillæ numerous; teeth present, but no tooth-papillæ. Arm-spines small and numerous, appressed to side arm-plates. Tentacle scales two. Genital slits small, *four* in each interradiar area, of which two lie close to oral shield, one on each side, and two are dorsal in position, lying just distal to radial shields; these dorsal slits are placed in slight prominences which carry papilliform granules, those adjoining the slits being the longest while the more distant ones merge into the disk granulation; the long axis of each slit is nearly at right angles to the long axis of the arm.

Type-species.—*Ophiura daniana* Verrill, 1867. Trans. Conn. Acad., Vol. 1, p. 254. From La Union, Salvador. Type in Peabody Museum, Yale University, New Haven, Conn.

In his description of the type-species, Verrill says: "The peculiarity in the form and position of the upper genital openings may hereafter require this species to be separated generically from *Ophiura*, if accompanied by corresponding internal differences in structure." In my judgment, such an extraordinary arrangement of the genital openings, indicating as it does an extreme development of the unusual condition characteristic of *Ophioderma*, is ample ground for establishing a new genus, regardless of "internal differences," although one can hardly doubt that such a marked external character is accompanied by internal peculiarities. The genus is a most interesting one and I have selected for its type the species described by Verrill, since it is possible that the following species will prove to be identical with it.

**Diopederma axiologum**<sup>2</sup> sp. nov.

Plate XLV, Figs. 5-7.

Disk 16 mm. in diameter; arms 54 mm. long; the smaller specimen is 10 mm. across. Disk pentagonal, very flat, closely covered with a fine granulation (about 150 grains to a square millimeter). This granulation leaves uncovered the greater part of each radial shield and the following plates in addition; in the type, a series of three plates along each radius, two lying between the radial shields and the third proximal to them; the first and biggest of these plates is larger than the first upper arm-plate, which lies distal to it; (the second, third, fourth, fifth and sixth upper arm-plates are each successively bigger, until the sixth is the widest of the upper arm-plates, while the succeeding plates are longer but become successively narrower; the first five plates are within the limits of the disk); a series of three or four small

<sup>1</sup> δι- = double, ὀπή = a hole in the roof, δέρμα = skin (the terminal portion of the name of the most nearly allied genus).

<sup>2</sup> ἀξιόλογος = remarkable.

plates in each interradius, the most distal the largest; a very small plate on each side of the first upper arm-plate, and two very small plates lying on each side of the radial series, proximal to the radial shields; in the smaller specimen, these plates are all relatively larger and are fully exposed; in addition, about forty other plates on the disc are bare, but these are small and do not seem to be definitely arranged. Around the dorsal genital slits, the granules are from a fourth to a third of a millimeter in length and are thus quite spiniform. Upper arm plates at base of arm, wider than long, tetragonal, in contact for their full width; they gradually become longer than wide and broader distally than proximally, until at tip of arm they are triangular and scarcely in contact. Interbrachial spaces below granulated distally but proximally the plates are simply bordered with minute grains. Genital slits very small; first pair (close to oral shield) is scarcely half the length of the first side-arm plate; second pair about as long, situated transverse to the long axis of the arm, in an elevation on the dorsal side of the disk, just distal to the radial shields. Oral shields distinctly longer than wide, hexagonal with rounded angles in the type, but in the smaller specimen more nearly triangular with a rounded, distal base. Adoral plates rather short and wide, at sides of oral shields; they meet within in the smaller specimen, but are widely separated in the type. Oral plates large, two thirds as large as adorals, bearing in the smaller specimen a few granules, which are much more numerous in the type. Oral papillae, nine on a side; ninth (distalmost) longest but very narrow; eighth largest, nearly as wide as long; inner ones successively narrower and more pointed. No pores between basal under arm-plates. First under arm-plate large, wider than long, roughly hexagonal; succeeding plates hexagonal, or somewhat octagonal, with rounded angles, broadly in contact, wider than long on basal third of arm but gradually becoming longer than wide and more pointed proximally, until at very tip of arm, they are triangular and well separated from each other; the fifth or sixth plate is widest, measuring in the type, 2 mm. wide and about 1 mm. long. Side arm-plates large, but broadly separated both above and below until near tip of arm; each plate carries on its distal margin, six (at middle of arm) to eleven (eighth side arm-plate), short, flat, appressed spines; uppermost sharply pointed, lower ones less noticeably so; third from bottom longest, about equal to one half the length of the arm-joint. Tentacle-scales two, inner the larger; outer does not overlap base of lowest arm-spine. Color (dried from alcohol) pale ashy-gray above, finely mottled with black and cream-color; most upper arm-plates have a light spot on their distal margin; arms faintly banded with blackish, some 15-20 indistinct dark markings showing on each arm; lower surface pale cream-color; smaller specimen like type, but a little darker.

Type — Cat. No. —, U. S. N. M. from Cape St. Lucas, L. C.

Whether these specimens represent a new species or should be referred to *Ophiura daniana* Verrill has been a source of much perplexity to me. Through the kindness of Miss K. J. Bush, one of the type specimens of Verrill's species was loaned me by the Peabody Museum and I have thus been enabled to compare the specimens from Lower California directly with one of those from Salvador. While the distance of fifteen hundred miles between the two localities is not specially significant, I have concluded that until specimens are known from the intervening coast, it will be quite

proper to consider the differences between the specimens as probably specific. The most striking of these differences is in the granulation of the disk; in the specimens from Lower California, many plates are exposed, while in the one from Salvador (see also Verrill's description) no plates except portions of some radial shields are free from the granules. The interbrachial areas below are also more closely granulated in the Salvadorian specimens, and the oral shields are less angular and more oval. These differences are not a matter of size, since Verrill's cotype is intermediate between the two from Cape St. Lucas, but it may be that they come well within the limits of individual variation in *daniana*. Until this can be shown however, the latter name may be kept for the southern specimens with no exposed disk plates, while *axiologum* should be used for the northern form with many exposed disk plates. If this difference is shown to be inconstant, then *axiologum* will become a synonym of *daniana*, but the status of the genus and its designated type will remain unaltered.

Cape St. Lucas. Two specimens.

### ***Ophiura flagellata.***

*Ophioglypha flagellata* LYMAN, 1878. Bull. M. C. Z., Vol. 5, p. 69.

*Ophiura flagellata* MEISSNER, 1901. Bronn's Thierreichs, Vol. 2, pt. 3, p. 925.

There is a single adult specimen with the disk 25 mm. across and well covered with plates. Lines of decalcification radiate from the center of the disk in each radius and interradius; the latter are the longer, extending two thirds of the way to the margin.

Station 5677. North of Cape San Lazaro, west coast of Lower California, 735 fms. Bottom Temp., 38.6°.

### ***Ophiura superba.***

*Ophioglypha superba* LÜTKEN and MORTENSEN, 1899. Mem. M. C. Z., Vol. 23, p. 116.

*Ophiura superba* MEISSNER, 1901. Bronn's Thierreichs, Vol. 2, pt. 3, p. 925.

*Ophiura hadra*, H. L. CLARK, 1911. Bull. U. S. Nat. Mus., No. 75, p. 80.

While comparing one of these newly taken specimens with a cotype of *superba* L. & M. and a cotype of *hadra* H. L. C., it became perfectly obvious that those two species are identical and there is no excuse to be offered for publishing *hadra* as a "new species." The present collection contains a good series, with disk-diameters ranging from 4 to 33 mm.

Station 5685. Southwest from Ballenas Bay, west coast of Lower California, 645 fms.

Station 5686. Off Ballenas Bay, west coast of Lower California, 930 fms. Bottom Temp., 37.3°.

Station 5693. Northwest of San Nicolas Island, California, 451 fms.

Station 5694. Southwest of Santa Cruz Island, California, 640 fms.

Station 5695. Southwest of Santa Rosa Island, California, 534 fms. Bottom Temp., 38.9°.

Station 5699. Southwest from Monterey Bay, California, 659 fms. Bottom Temp., 37.9°.

Bathymetrical range, 451-930 fms. Temperature range, 38.9°-37.3°. Thirty-two specimens.

### ***Ophiura irrorata.***

*Ophioglypha irrorata* LYMAN, 1878. Bull. M. C. Z., Vol. 5, p. 73.

*Ophiura irrorata* MEISSNER, 1901. Bronn's Thierreichs, Vol. 2, pt. 3, p. 925. See also H. L. Clark, 1911. Bull. U. S. Nat. Mus., No. 75, p. 62.

Three very large specimens add a new locality to the range of this almost cosmopolitan species. The largest one (disk-diameter, 38 mm.) is considerably larger than any that has hitherto been recorded.

Station 5684. Southwest from Magdalena Bay, east coast of Lower California, 1760 fms.

### ***Ophiura leptoctenia.***

H. L. Clark, 1911. Bull. U. S. Nat. Mus., no. 75, p. 51.

The finding of this species off central and southern California extends its known range far southward. None of the specimens are noteworthy.

Station 5694. Southwest of Santa Cruz Island, California, 640 fms.

Station 5695. Southwest of Santa Rosa Island, California, 534 fms. Bottom Temp., 38.9°.

Station 5699. Southwest from Monterey Bay, California, 659 fms. Bottom Temp., 37.9°.

Twenty-eight specimens.

### ***Ophiura ponderosa.***

*Ophioglypha ponderosa* LYMAN, 1878. Bull. M. C. Z., Vol. 5, p. 93.

*Ophiura ponderosa* MEISSNER, 1901. Bronn's Thierreichs, Vol. 2, pt. 3, p. 925.

A single small specimen is the only representative of this species.

Station 5694. Southwest of Santa Cruz Island, California, 640 fms.



**Ophiura oligopora**<sup>1</sup> sp. nov.

Plate XLV, Figs. 8 and 9.

Disk 9 mm. in diameter (6 in the smaller specimen); arms broken but about 22 mm. long. Disk moderately high, especially the radial areas; the center is somewhat depressed. Disk covered by some 200 plates, among which the central primary plate and a plate near each interradiar margin are rather conspicuous; in the smaller specimen the primary radial plates are also easily made out. Radial shields large, (longer than wide), in contact at middle and distally, but with outer ends separated by first upper arm-plate and inner ends separated by one or two large scales. All the plates of the disk are thick and many are more or less swollen, but there are no knobs or tubercles developed. Arms rather short, nearly cylindrical. Upper arm-plates tetragonal, the proximal margin less than the distal; outer corners rounded; first three or four plates wider than long but remaining plates increasingly longer than wide; all broadly in contact so far as the broken arms indicate. Interbrachial areas below covered by 30-35 plates. Oral shields larger, longer than wide, pentagonal with a proximal angle, which the adoral plates adjoin, and the outer corners rounded; genital slits cause a slight reëntrant angle on each side. Adoral plates narrow, on proximal sides of oral shields; oral plates about equal in size to adorals, swollen at proximal end. Oral papillæ about five on a side; outermost as wide as next two together; only innermost, papilliform. Genital slits long and conspicuous. Genital scales short and wide distally; broadly visible from above; each scale carries ten or a dozen small papillæ, which form a continuous series orally with the minute papillæ on margin of genital slit; aborally the two or three papillæ, visible from above, are the largest, but they are inconspicuous and the arm-comb has the appearance of incompleteness. First under arm-plate very large, almost as large as second, wider than long, imperfectly octagonal with rounded corners; second plate pentagonal, wider than long; third plate similar but proximal side very short and distal angle rounded, about as long as wide; succeeding plates wider than long becoming almost spindle-shaped but outer corners rather obtuse; all the plates except first and second (and in the type, the second and third) are separated from each other. Side arm-plates large, broadly in contact beneath but narrowly separated above, at least on basal half of arm; each plate bears three minute, well-spaced, blunt, peg-like arm-spines, of which the uppermost is a trifle the longest. Oral tentacle-pores not opening into mouth-slit, guarded on either side by three or four small scales; on succeeding pores the number of scales becomes rapidly reduced, until on the fifth pore there are only two scales on outer side and one on inner; the seventh pore has one tentacle-scale and after that not even a pore is visible. Color (dried from alcohol), white.

Type.—Cat. No. 00000, U. S. N. M. from Station 5683.

Comparison of descriptions alone shows that this species is very near *O. rugosa* Lyman, collected by the 'Challenger' in 700 fms. near New Zealand. Comparison of specimens of the same size however, reveals

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<sup>1</sup> ὀλίγος = few + πόρος = pore, in reference to the reduction of the tentacle-pores.



differences which show that we are dealing with two species. The general appearance is dissimilar because the disk-scales of *rugosa* are fewer and much more swollen, and the arms, while fully as short, are much more slender. The arm-spines too are pointed and the upper arm-plates and oral shields have a different shape. Apparently the tentacle pores do not continue to the tip of the arm in *rugosa* but there seem to be more than in *oligopora*.

This new species is quite unlike any yet recorded from the western Pacific ocean and is not likely to be confused with any of them. It was taken, unfortunately, at only one station.

Station 5683. Off Cape St. Lucas, Lower California, 630 fms. Bottom Temp., 39.1°. Two specimens.

### ***Ophiocten pacificum.***

Lütken and Mortensen, 1899. Mem. M. C. Z., Vol. 23, p. 131.

This is apparently one of the commonest ophiurans of the North Pacific ocean, as it has been found in numbers by the 'Albatross' at numerous stations from Ecuador to Washington, and in Japanese waters as well. Most of the specimens in the present collection are in very poor condition and are not noteworthy.

Station 5673. Off Pt. San Tomas, west coast of Lower California, 1090 fms.

Station 5688. Off Cedros Island, west coast of Lower California, 525 fms. Bottom Temp., 39.9°.

Station 5689. Off Rosario Bay, west coast of Lower California, 879 fms.

Station 5691. Off Pt. San Tomas, west coast of Lower California, 868 fms. Bottom Temp., 37.2°.

Station 5692. Off Pt. San Tomas, west coast of Lower California, 1076 fms. Bottom Temp., 37.1°.

Station 5693. Northwest of San Nicolas Island, California, 451 fms.

Station 5694. Southwest of Santa Cruz Island, California, 640 fms.

Station 5695. Southwest of Santa Rosa Island, California, 534 fms. Bottom Temp., 38.9°.

Bathymetrical range, 451 to 1090 fms. Temperature range, 39.9°-37.1°.

Two hundred and thirty-three specimens.

**Ophiernus adpersus.**

Lyman, 1883. Bull. M. C. Z., Vol. 10, p. 236.

For some notes in regard to this specimen, see under the following species.

Station 5676. Off San Juanico, west coast of Lower California, 647 fms. Bottom Temp., 39°. One specimen.

**Ophiernus polyporus.**

Lütken and Mortensen, 1899. Mem. M. C. Z., Vol. 23, p. 109.

A dozen or more specimens of *Ophiernus* seem to be referable to this species, but studying them in connection with the single specimen just mentioned has raised grave doubts as to whether *polyporus* is a valid species, distinct from *adpersus*, or not. The specimen of *adpersus* listed above from station 5676 is a large adult and comparison with West Indian specimens shows it is a typical example of the species. Another specimen, almost exactly like it, and also from station 5676, has the characteristic pores of *polyporus* present on the fifth joint of each arm and in four of the arms on one or both sides of the fourth or sixth joint, and in one arm on the seventh and eighth joints also; the pores are smaller than in a typical *polyporus* but are otherwise similar. In a third specimen from the same station, the pores are present on the third to eighth joints of all the arms. In typical *polyporus*, the pores extend out to the fifteenth to twenty-fifth joint. So far as I can see the presence of these pores is the only thing which distinguishes *polyporus* from *adpersus*, and I have therefore drawn an arbitrary line by which one of these specimens (as noted above) is set off as *adpersus* and the rest are called *polyporus*. The available material is in too poor condition for me to satisfy myself as to whether the presence of a few pores is indicative of hybridization or whether the presence and number of pores is a matter of individual diversity. The fact that *polyporus* has as yet been taken only in the vicinity of southern Lower California, off the Mexican coast and near Panama, while *adpersus* is practically cosmopolitan in deep water, indicates the specific importance of the pores. Better material must be awaited before the question can be definitely settled. Apparently *Ophiernus* is very fragile, all reported material being more or less badly damaged by its collection or journey in the trawl. The specimens of *polyporus* in the present collection were taken at the following points:

Station 5676. Off San Juanico, west coast of Lower California, 647 fms. Bottom Temp., 39°.

Station 5682. Off Cape St. Lucas, Lower California, 491 fms. Bottom Temp., 40.8°.

Fourteen specimens.

### **Ophiomusium glabrum.**

Lütken and Mortensen, 1899. Mem. M. C. Z., Vol. 23, p. 132.

*Ophiomusium multispinum* H. L. CLARK, 1911. Bull. U. S. Nat. Mus., No. 75, p. 113.

This is one of the commonest deep water ophiurans of the western Pacific, ranging from the equator to 47° N. lat. in water from 480 to 2232 fms. deep. The largest specimen in the present collection has the disk 35 mm. across and comparison of this individual with a cotype of *multispinum* shows that the latter is, as I suspected when describing it, identical with *glabrum*. The differences pointed out are individual and not specific, proving to be quite inconstant.

Station 5673. Off Pt. San Tomas, west coast of Lower California, 1090 fms.

Station 5684. Southwest from Magdalena Bay, west coast of Lower California, 1760 fms.

Station 5686. Off Ballenas Bay, west coast of Lower California, 930 fms. Bottom Temp., 37.3°.

Station 5687. Off Pt. Santa Eugenia, west coast of Lower California, 480 fms. Bottom Temp., 41.1°.

Station 5689. Off Rosario Bay, west coast of Lower California, 879 fms.

Station 5690. Off Rosario Bay, west coast of Lower California, 1101 fms. Bottom Temp., 38.1°.

Station 5691. Off Pt. San Tomas, west coast of Lower California, 868 fms. Bottom Temp., 37.2°.

Bathymetrical range, 480–1760 fms. Temperature range, 41.1°–37.2°. Seventy specimens.

### **Ophiomusium lymani.**

Wyville Thomson, 1873. The Depths of the Sea, p. 172.

This, the commonest and most widespread of deep-sea ophiurans, is represented by a large and uninteresting series of specimens, whose disk-diameters range from  $2\frac{1}{2}$  to 30 mm.

Station 5673. Off Pt. San Tomas, west coast of Lower California, 1090 fms.

Station 5686. Off Ballenas Bay, west coast of Lower California, 930 fms. Bottom Temp., 37.3°.

Station 5689. Off Rosario Bay, west coast of Lower California, 879 fms.

Station 5690. Off Rosario Bay, west coast of Lower California, 1101 fms. Bottom Temp., 38.1°.

Station 5691. Off Pt. San Tomas, west coast of Lower California, 868 fms. Bottom Temp., 37.2°.

Station 5692. Off Pt. San Tomas, west coast of Lower California, 1076 fms. Bottom Temp., 37.1°.

Bathymetrical range, 868–1101 fms. Temperature range, 38.1°–37.1°.

Two hundred and thirteen specimens.

### ***Amphiura carchara.***

H. L. Clark, 1911. Bull. U. S. N. M., No. 75, p. 142.

The occurrence of this species off Lower California extends its range very far southwards on the American coast. The specimens range from 4 to 8 mm. across the disk but show no notable peculiarities.

Station 5673. Off Pt. San Tomas, west coast of Lower California, 1090 fms. Four specimens.

### ***Amphiura diomedææ.***

Lütken and Mortensen, 1899. Mem. M. C. Z., Vol. 23, p. 151.

This wide-ranging species is represented by four adult specimens; in one the disk-diameter exceeds 15 mm. but the arms are all broken; in another the disk measures 13 mm. across and one of the arms is about 135 mm. or fully ten times the disk-diameter.

Station 5694. Southwest of Santa Cruz Island, California, 640 fms.

Station 5698. Off Monterey County, California, 475 fms. Bottom Temp., 39.9°.

Station 5699. Southwest from Monterey Bay, California, 659 fms. Bottom Temp., 37.9°.

***Amphiura serpentina.***

Lütken and Mortensen, 1899. Mem. M. C. Z., Vol. 23, p. 143.

Although the specimens are not in very good condition, I do not think the identification is in doubt. They seem to be intermediate between the typical form and the var. *a* of Lütken and Mortensen.

Station 5683. Off Cape St. Lucas, Lower California, 630 fms. Bottom Temp., 39.1°.

Station 5685. Southwest from Ballenas Bay, west coast of Lower California, 645 fms.

Station 5698. Off Monterey County, California, 475 fms. Bottom Temp., 39.9°.

Six specimens.

***Amphiodia dalea.***

*Amphiura dalea* LYMAN, 1879. Bull. M. C. Z., Vol. 6, p. 27.

These specimens, of which the largest is 15 mm. across the disk, agree almost exactly with those discussed by Lütken and Mortensen (1899, Mem. M. C. Z., Vol. 23, p. 154), and on comparison with cotypes from the southern Atlantic I find no reason to criticize their identification. Verrill (1899, Trans. Conn. Acad., Vol. 10, p. 315) places the species in *Amphioplus*, no doubt because of Lyman's figure, but as Lütken and Mortensen point out that figure is misleading. There are really only three oral papillæ on each side.

Station 5684. Southwest from Magdalena Bay, west coast of Lower California, 1760 fms.

Station 5692. Off Pt. San Tomas, west coast of Lower California, 1076 fms. Bottom Temp., 37.1°.

Three specimens.

***Ophionereis annulata.***

*Ophiolepis annulata* LECONTE, 1851. Proc. Acad. Nat. Sci. Phila., Vol. 5, p. 317.

*Ophionereis annulata* LYMAN, 1860. Proc. Boston Soc. Nat. Hist., Vol. 7, p. 203.

There is a good series of this well known species, the smallest 5 mm., the largest 18 mm., across the disk.

Northern end, east side, Cedros Island, west coast of Lower California.

San Francisquito Bay, east coast of Lower California.

Pichilingue Bay, east coast of Lower California.

Forty specimens.

***Ophiacantha bairdi.***

Lyman, 1883. Bull. M. C. Z., Vol. 10, p. 256.

The specimens are all in poor condition and call for no comment.

Station 5688. Off Cedros Island, west coast of Lower California, 525 fms. Bottom Temp., 39.9°.

Station 5693. Northwest of San Nicolas Island, California, 451 fms.

Five specimens.

***Ophiacantha bathybia.***

H. L. Clark, 1911. Bull. U. S. Nat. Mus., No. 75, p. 233.

These specimens call for no special comment but the occurrence of the species off Lower California extends its range very far southward. The bathymetrical and temperature ranges are scarcely affected however.

Station 5673. Off Pt. San Tomas, west coast of Lower California, 1090 fms.

Station 5691. Off Pt. San Tomas, west coast of Lower California, 868 fms. Bottom Temp., 37.2°.

Twelve specimens.

***Ophiacantha moniliformis.***

Lütken and Mortensen, 1899. Mem. M. C. Z., Vol. 23, p. 171.

These specimens extend the range of this species considerably to the northward and into much shallower water.

Station 5675. Southwest of San Cristobal Bay, west coast of Lower California, 284 fms. Bottom Temp., 44.6°. Three specimens.

***Ophiacantha normani.***

Lyman, 1879. Bull. M. C. Z., Vol. 6, p. 58.

This species is one of the most common in the North Pacific ocean, and there is nothing notable about its numerous representatives in the present collection.

Station 5694. Southwest of Santa Cruz Island, California, 640 fms.

Station 5695. Southwest of Santa Rosa Island, California, 534 fms.  
Bottom Temp., 38.9°.

Station 5698. Off Monterey County, California, 475 fms. Bottom  
Temp., 39.9°.

Station 5699. Southwest from Monterey Bay, California, 659 fms.  
Bottom Temp., 37.9°.

Bathymetrical range, 475–659 fms. Temperature range, 39.9°–37.9°.

One hundred and fifty-three specimens.

### ***Ophiacantha rhachophora.***

H. L. Clark, 1911. Bull. U. S. N. M., No. 75, p. 201.

There is always room for doubt in the identification of small *Ophiacanthas* and the occurrence of this species on the coast of California and near Cape St. Lucas is certainly unexpected, but after comparing the present specimens with others from Bering Sea and Japan, I think they may fairly be called *rhachophora*. It is quite likely however, that the young of several species are now included under that name. The largest of these specimens has the disk only 7 mm. across.

Station 5683. Off Cape St. Lucas, Lower California, 630 fms. Bottom  
Temp., 39.1°.

Station 5693. Northwest of San Nicolas Island, California, 451 fms.

Station 5695. Southwest of Santa Rosa Island, California, 534 fms.  
Bottom Temp., 38.9°.

Twelve specimens.

### ***Ophiocoma æthiops.***

Lütken, 1859. Add. ad Hist., pt. 2, p. 145.

Only a single specimen of this common Panamic species is in the collection. It is a large adult from Angel de la Guardia Island, Gulf of California.

### ***Ophiocoma alexandri.***

Lyman, 1860. Proc. Boston Soc. Nat. Hist., Vol. 7, p. 256.

There is a good series of this less common species but it was only found at one locality.

San Francisquito Bay, east coast of Lower California. Ten specimens.



**Ophiothrix spiculata.**

LeConte, 1851, Proc. Acad. Nat. Sci., Philadelphia, Vol. 5, p. 318.

Another common Panamic species, this *Ophiothrix*, is represented by only a small series, mostly in poor condition.

San Esteban Island, Gulf of California.

San Francisquito Bay, east coast of Lower California.

Station 5678. Magdalena Bay, west coast of Lower California, 13½ fms.

Five specimens.

**Astroschema sublæve.**

Lütken and Mortensen, 1899. Mem. M. C. Z., Vol. 23, p. 187.

This fine species is represented by only a single specimen, but that is an adult in beautiful condition.

Station 5695. Southwest of Santa Rosa Island, California, 534 fms. Bottom Temp., 38.9°.

**Asteronyx dispar.**

Lütken and Mortensen, 1899. Mem. M. C. Z., Vol. 23, p. 185.

The large series of *Asteronyx* in the collection fall into three groups, representing species two of which were found by the 'Albatross' in 1891 in her exploration of the Panamic region, while the third was taken by the same vessel at numerous stations from California northward to Bering Sea. It is interesting to note that no two of these species occurred at the same station either in 1891 or in 1911. The present species, *dispar*, has a wide range, extending from the Galapagos archipelago to southern California. It seems to be a well defined species, easily recognized by the number and appearance of the arm-spines. The specimens at hand range in disk-diameter from 5 to 17 mm.

Station 5689. Off Rosario Bay, west coast of Lower California, 879 fms.

Station 5690. Off Rosario Bay, west coast of Lower California, 1101 fms. Bottom Temp., 38.1°.

Station 5691. Off Pt. San Tomas, west coast of Lower California, 868 fms. Bottom Temp., 37.2°.

Station 5692. Off Pt. San Tomas, west coast of Lower California, 1076 fms. Bottom Temp., 37.1°.

Station 5693. Northwest of San Nicolas Island, California, 451 fms.  
Bathymetrical range, 451-1101 fms. Temperature range, 38.1°-37.1°.  
Twenty-one specimens.

### ***Asteronyx excavata.***

Lütken and Mortensen, 1899. Mem. M. C. Z., Vol. 23, p. 185.

This species seems to be confined to the region of southern Lower California and the Tres Marias Islands. It was found in the latter area by the 'Albatross' in 1891. It is a well characterized, and apparently rare species. The largest specimen in the present collection is 26 mm. across the disk, or about one third larger than the specimen described by Lütken and Mortensen.

Station 5682. Off Cape St. Lucas, Lower California, 491 fms. Bottom Temp., 40.8°.

Station 5688. Off Cedros Island, west coast of Lower California, 525 fms. Bottom Temp., 39.9°.

Five specimens.

### ***Asteronyx loveni.***

Müller and Troschel, 1842. Sys. Ast., p. 119.

Except for the large lot (79) of young specimens taken at Station 5675, this well known species was not common, but was taken only three times and then off the coast of California. The largest specimens from Station 5675 are only 16 mm. across the disk and while I fail to find any good reason for not calling them *loveni*, I confess to being suspicious of them. They are certainly not either *plana*, *dispar* or *excavata* and comparison with young *loveni* from off British Columbia and Alaska has made me feel they should be called *loveni*. If some adult *loveni* had been taken at the same or some neighboring station, I should be better satisfied with my decision.

Station 5675. Southwest of San Cristobal Bay, west coast of Lower California, 284 fms. Bottom Temp., 44.6°.

Station 5694. Southwest of Santa Cruz Island, California, 640 fms.

Station 5698. Off Monterey County, California, 475 fms. Bottom Temp., 39.9°.

Station 5699. Southwest from Monterey Bay, California, 659 fms. Bottom Temp., 37.9°.

Bathymetrical range, 284-659 fms. Temperature range, 44.6°-37.9°.

Eighty-two specimens.

## ECHINOIDEA

***Eucidaris thouarsii*.**

*Cidaris thouarsii* AGASSIZ and DESOR, 1846. Ann. Sci. Nat., Vol. 6, p. 326.

*Eucidaris thouarsii* DÖDERLEIN, 1887. Jap. Seeigel, p. 42.

There is only a single specimen, a small one, from San Josef Island, Gulf of California.

***Centrostephanus coronatus*.**

*Echinodiadema coronata* VERRILL, 1867. Trans. Conn. Acad., Vol. 1, p. 294.

*Centrostephanus coronatus* A. AGASSIZ, 1872. Rev. Ech., Pt. 1, p. 97.

This little known species is represented simply by young individuals, the largest only 25 mm. h. d.<sup>1</sup>

San Josef Island, Gulf of California.

San Esteban Island, Gulf of California.

Agua Verde Bay, east coast of Lower California.

Five specimens.

***Arbacia incisa* comb. nov.**

*Echinocidaris incisa* A. AGASSIZ, 1863. Bull. M. C. Z., Vol. 1, p. 20.

(= *Arbacia stellata*, *Echinus stellatus* DE BLAINVILLE, 1825, non Gmelin, 1788).

Since it is certain that *Echinus stellatus* of de Blainville is not identical with *Echinus stellatus* Gmelin, it is clear that the name cannot be used for de Blainville's species even though we do not know at present what species Gmelin had in mind. A. Agassiz's name seems to be the first available one. The species is characteristic of the Panamic region and while its northern limit is not yet definitely known, it is probably south of the United States. In 1901, I published (Proc. Boston Soc. Nat. Hist., Vol. 29, pp. 331, 332) records of the occurrence of this and four other Panamic echini and one or more Panamic starfishes, in Puget Sound. Some years later it came out that the collections sent to me as from Puget Sound, contained material not only from Puget Sound but from some point on the Pacific coast south of the United States and also apparently from the West Indies. Fisher (1911, Bull. U. S. Nat. Mus. No. 76) has recently called attention to this regrettable fact, in the case of the starfishes and I therefore

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<sup>1</sup> This abbreviation for "horizontal diameter" will be used throughout this report.

wish to correct, so far as possible, the errors concerning the Echini. The *Arbacia stellata* recorded is undoubtedly from somewhere in the Panamic region, on the west coast of Central America or Mexico, or in the Gulf of California. The same is true of the *Diadema mexicanum*, *Toxopneustes semituberculatus* and *Clypeaster rotundus*. As near as can be determined now the "*Echinometra oblonga*" was an *Echinometra lucunter* from the West Indies but as the specimen seems to be no longer extant, the matter cannot be positively determined.

None of the *Arbacias* in the present 'Albatross' collection are adult, the largest being only 17 mm. h. d.

San Josef Island, Gulf of California.

San Esteban Island, Gulf of California.

Agua Verde Bay, Gulf of California.

Twelve specimens.

### **Lytechinus anamesus.**

H. L. Clark, 1912. Mem. M. C. Z., Vol. 34, p. 254.

This recently described species was met with at only one place, although it is widely spread in the region. The largest specimen is very much larger than any previously known, measuring 37 mm. h. d. and 23 mm. high.

San Bartolomé Bay, west coast of Lower California.

Off Pt. San Bartolomé, west coast of Lower California, with "boat-dredge." Depth not given. March 14, 1911.

Six specimens.

### **Lytechinus pictus.**

*Psammechinus pictus* VERRILL, 1867. Trans. Conn. Acad. Vol. 1, p. 301.

*Lytechinus pictus* H. L. CLARK, 1912. Mem. M. C. Z., Vol. 34, p. 258.

All of the specimens are young, the largest only about 16 mm. h. d.

"Lower California."

Agua Verde Bay, east coast of Lower California.

Twenty-six specimens.

### **Strongylocentrotus fragilis.**

Jackson, 1912. Mem. Boston Soc. Nat. Hist., Vol. 7, p. 128.

This is still another species represented only by young specimens, the largest only about 40 mm. h. d.

Station 5687. Off Pt. Santa Eugenia, west coast of Lower California, 480 fms. Bottom Temp., 41.1°.

Station 5694. Southwest of Santa Cruz Island, California, 640 fms.

Station 5696. Off San Luis Obispo County, California, 440 fms. Bottom Temp., 39.9°.

Three specimens.

### **Strongylocentrotus franciscanus.**

*Toxoidaris franciscana* A. AGASSIZ, 1863. Bull. M. C. Z., Vol. 1, p. 22.

*Strongylocentrotus franciscanus* A. AGASSIZ, 1872. Rev. Ech., Pt. 1, p. 163.

There are two specimens in the collection, about 75-85 mm. h. d. Both are obviously young but the failure to find more than *eight* pairs of pores in an arc has surprised me, for *nine* is the number characteristic of the species and ought to be found in many arcs of specimens as old as these. The spines are unmistakable however. Both specimens are from Cedros Island, west coast of Lower California, which is probably the southern limit of the species.

### **Strongylocentrotus purpuratus.**

*Echinus purpuratus* STIMPSON, 1857. Jour. Bost. Soc. Nat. Hist., Vol. 6, p. 86.

*Strongylocentrotus purpuratus* A. AGASSIZ, 1872. Rev. Ech., Pt. 1, p. 165.

As in the case of the preceding species, Cedros Island, west coast of Lower California, must be the southern limit of this form. A single specimen from that Island, about 50 mm. h. d., is the sole representative of *purpuratus* in the collection.

### **Echinometra vanbrunti.**

A. Agassiz, 1863. Bull. M. C. Z., Vol. 1, p. 21.

There are four, fine adult specimens, about 70 mm. longer h. d., from Santa Maria Bay, west coast of Lower California. How much further north it ranges has yet to be determined.

### **Encope grandis.**

L. Agassiz, 1841. Mon. Scut., p. 75.

There is a fine series of adults of this extraordinary clypeastroid. They are mostly about 100 mm. across, the length usually not quite so much.

The largest is 110 mm. across, but only 92 mm. long, owing to the fact that both posterior divisions of the test (between the median lunule and the postero-lateral notches) were long ago lost (bitten off?) and although healed are not at all regenerated. One specimen is 25 mm. across, and the lunule and all the notches, except the mid-anterior, are distinct. The smallest specimen is about 14 mm. across and only the lunule and posterior notches are clearly seen. These small specimens are pale brown, almost fawn-color, while the adults are deep purplish-brown, almost black.

Cape St. Lucas, Lower California.

Mulege Bay, east coast of Lower California.

Tiburon Island, Gulf of California.

Nineteen specimens.

### **Encope micropora.**

L. Agassiz, 1841. Mon. Scut., p. 50.

These specimens are all large, measuring 90-120 mm. across, the length not quite equalling the width. The color varies from dull yellowish-brown to almost black. One specimen is labelled "Tiburon Island" but as all the others are from the west coast of Lower California, while the other Encopes from Tiburon Island are *grandis*, it seems possible there may have been a slip in the labelling. Yet in view of the wide range of *micropora*, its occurrence in the Gulf of California is most probable; indeed, it has been recorded from Guaymas, Mexico.

Ballenas Bay, west coast of Lower California.

South end of Magdalena Bay, west coast of Lower California.

Tiburon Island, Gulf of California.

Ten specimens.

### **Urechinus loveni.**

*Cystechinus loveni* A. AGASSIZ, 1898. Bull. M. C. Z., Vol. 32, p. 79.

*Urechinus loveni* MORTENSEN, 1907. "Ingolf" Ech., Pt. 2, p. 50.

This rare and remarkable echinoid is represented by only one complete specimen, although the fragments of a number of others show that it is common in certain places such as Station 5684. The test is so thin and fragile and the depth at which the animals live is so great, it must be rarely indeed that unbroken specimens are brought to the surface. The larger of the two measurable specimens before me is 70 mm. long, 63 mm. wide and 43 mm. high. According to Agassiz's figure, his specimen, 88 mm.

long, was 75 mm. wide and 60 mm. high, and so was some seven per cent higher than mine. But some of the fragments at hand indicate higher tests than that of the whole specimen, so I do not think this difference is important. The color of the test is deep reddish-purple, but this color seems to be superficial and easily rubbed off leaving the bare plates purplish-white. Excepting that no globiferous ones were found, the pedicellariæ agree well with the description and figures given by Mortensen (l. c.). I agree with the latter that *Cystechinus* cannot be distinguished from *Urechinus*.

Station 5684. Southwest from Magdalena Bay, west coast of Lower California, 1760 fms. Eight (?) specimens.

### ***Urechinus reticulatus*<sup>1</sup> sp. nov.**

Plate XLVI, Figs. 10-13.

Length of test, 67 mm.; breadth, 62 mm.; height, 46 mm. Color deep reddish purple, but spines, pedicellariæ and the surface of each plate, except around margin, dull greenish-yellow. The effect of this coloration is a yellowish animal, handsomely reticulated with deep purple. The plates composing the test are noticeably higher in proportion to their width than in *loveni*, from the ambitus upward. The plates of the ambulacra differ little from those of the ambulacra in either height or width. Thus the antero-lateral ambulacrum is 21 mm. wide at ambitus and has 20-21 plates in each column, while the antero-lateral interambulacrum is 21.5 mm. wide and has 17-18 plates in each column. An ambulacral plate just above the ambitus is 10 mm. wide and 7 mm. high; an adjoining interambulacral plate is 9.5 mm. wide and 8 mm. high. The abactinal system is somewhat distorted and obviously not normal; the madreporic genital lies, as in *U. loveni*, directly in the long axis of the animal, but there are only two genital pores, a left anterior, in a plate separate from the madreporic genital, and a right posterior; the oculars are distorted and the left posterior genital seems to be imperforate. The periproct is just below the ambitus, on an oblique surface, and not completely actinal as in *loveni*. The mouth is more nearly central than in *loveni*, lying more than two fifths of the long axis back of the anterior margin, while in *loveni*, it is distinctly less.

The pedicellariæ are exceedingly characteristic and indicate that this species is quite distinct from *loveni*. Four kinds of pedicellariæ were found, but the globiferous are very uncommon, only two being seen. The *ophicephalous* pedicellariæ are not to be distinguished certainly from those of *loveni*; they occur chiefly in the region about the periproct. The *ordinary tridentate* are similar to those of *loveni* but are at once distinguishable by the low basal portion of the valves with straight lateral margins; in *loveni*, the base is higher and its lateral margins are angular and often with a tooth at the angle. The most conspicuous pedicellariæ on *reticulatus* are the *stout, tridentate*, which are common around the mouth and abundant on the periproct. The heads are very robust, the valves measuring .40 to .60 mm. long and .25 to .40 mm. wide. The blade is nearly circular (*i. e.* as wide as it is long) but otherwise the valves are much like those of *naresianus* as figured by Mortensen (l. c.

<sup>1</sup> *reticulatus* = with lines like the meshes of a net.



Plate IX, fig. 15). The *globiferous* pedicellariæ have the basal part of the valves about as long as wide, while the tubular blade is somewhat shorter; the opening of the blade has a lower lip from which extend horizontally four, five or even six, very slender teeth, much longer than the diameter of the blade; the back or upper lip of the opening has an angular margin but carries no teeth. The valves are about .40 mm. long and the teeth below the opening of the blade are about .08 mm. While these pedicellariæ are no doubt of the same general structure as those of *Urechinus giganteus*, they are not at all like them in detail, yet I know of no others which they resemble more closely.

Type.—Cat. No. —, U. S. N. M., from Station 5689.

Before examining the pedicellariæ, I was inclined to consider this unique specimen, a peculiar individual variant of *loveni*, but the pedicellariæ are so characteristic, I have no doubt that *reticulatus* is a good species. The test is higher, firmer and apparently thicker than in *loveni*, but these may be simply characters associated with the much shallower water in which the specimen was taken. Possibly the shallower habitat is characteristic of the species.

Station 5689. Off Rosario Bay, west coast of Lower California, 879 fms.

### **Schizaster townsendi.**

A. Agassiz, 1898. Bull. M. C. Z., Vol. 32, p. 82.

The occurrence of this species off California extends its known range of distribution far to the northward. The specimens range from 18 to 54 mm. in length, the latter being somewhat larger than Agassiz's biggest specimen.

Station 5696. Off San Luis Obispo County, California, 440 fms. Bottom Temp., 39.9°.

Station 5697. Off Monterey County, California, 485 fms. Bottom Temp., 39.8°.

Thirty-two specimens.

### **Schizaster latifrons.**

A. Agassiz, 1898. Bull. M. C. Z., Vol. 32, p. 81.

This species, originally taken in the Gulf of California in 995 fms., seems to have a more restricted range both geographically and bathymetrically than the preceding. Attention should be called to the fact that the figures published in 1898 as representing this species really represent the preceding species, *townsendi* (see A. Agassiz, 1904, Panamic Ech., p. 207). The figures in "Panamic Echini" (Plate 102, figs. 1-4) give a good idea of the species, although the specimen was a very small one. In the present

collection there is one individual 58 mm. long. In large specimens, the unpaired ambulacrum is not so extraordinarily broad, but the short posterior petals will always distinguish this species from *townsendi*.

Station 5683. Off Cape St. Lucas, Lower California, 630 fms. Bottom Temp., 39.1°.

Station 5685. Southwest from Ballenas Bay, west coast of Lower California, 645 fms.

Station 5694. Southwest of Santa Cruz Island, California, 640 fms.

Six specimens.

### **Brissopsis columbaris.**

A. Agassiz, 1898. Bull. M. C. Z., Vol. 32, p. 82.

The specimens are small, less than 35 mm. long, and one is broken in fragments. Their occurrence off Cape St. Lucas, while not at all unexpected, extends the known range considerably to the north.

Station 5682. Off Cape St. Lucas, Lower California, 491 fms. Bottom Temp., 40.8°.

Two specimens.

### **Brissopsis pacifica.**

*Toxorissus pacificus* A. AGASSIZ, 1898. Bull. M. C. Z., Vol. 32, p. 83.

*Brissopsis* (*Toxorissus*) *pacifica* MORTENSEN, 1907. "Ingolf" Ech., Pt. 2, p. 44.

Although this species was abundant at Station 5675, it was not found elsewhere. The specimens range from 11 to 34 mm. in length, none of them being full grown. Some are remarkably flattened, the abactinal surface being more or less concave rather than convex; one such specimen is 26 mm. long, 24 mm. wide, 8 mm. thick at margin and 6 mm. thick at center of abactinal system. The cause of such a deformity is not easy to imagine. The species was previously known only from Panama.

Station 5675. Southwest of San Cristobal Bay, west coast of Lower California, 284 fms. Bottom Temp., 44.6°.

One hundred and seventy specimens.

### **Lovenia cordiformis.**

A. Agassiz, 1872. Bull. M. C. Z., Vol. 3, p. 57.

A single small specimen, only 20 mm. long, from Cape St. Lucas, is the sole representative of this species in the collection.

## HOLOTHURIOIDEA.

**Leptosynapta inhærens.**

*Holothuria inhacrens* O. F. MÜLLER, 1776. Zool. Dan. Prod., p. 232.

*Leptosynapta inhærens* VERRILL, 1867. Trans. Conn. Acad., Vol. 1, p. 325.

There are two synaptids in the collection, which agree in all respects with each other, and except for color and texture of the body wall, I cannot distinguish them from *L. inhaerens*. But the body wall is soft and rather thick and the color is nearly black. The texture of the body wall may be the result of having been at first preserved in formalin, though there is no other indication of that reagent, but for the color I am quite unable to account. Each specimen is about 40 mm. long; the anchors are .16 mm. and the plates .14 mm. long in the posterior part of the body. Unfortunately the locality of these specimens is quite uncertain; one was in a jar with the specimens of *Holothuria lubrica*, which lacked a locality label; while the other was in a vial with the label "Station 5684." Now since the depth at station 5684 was 1760 fms., it is impossible to believe that this characteristically littoral genus occurs at that place. The appearance of the two specimens is such that I have little doubt both came from the same littoral station where the *Holothuria lubrica* were taken.

**Protankyra abyssicola.**

*Synapta abyssicola* THÉEL, 1886. "Challenger" Holoth.: Pt. II, p. 14.

*Protankyra abyssicola* ÖSTERGREN, 1898. Öfv. Kong. Vet. Ak. Forhandl., Vol. 55, p. 116.

The specimens are all more or less fragmentary and in poor condition. The largest one is about 90 mm. long and was probably 150 mm. in life. The anchors have 2-7 teeth on each arm, so that the specimens cannot be referred to *P. pacifica*. Further material is necessary to show whether the latter species can be maintained. In the light of the present material, it seems quite improbable. These specimens are strongly tinged with red, due to a red pigment in the skin. In one specimen, this pigment was of a blackish-brown color.

Station 5673. Off Pt. San Tomas, west coast of Lower California, 1090 fms.

Station 5684. Southwest from Magdalena Bay, west coast of Lower California, 1760 fms.

Station 5698. Off Monterey County, California, 475 fms. Bottom Temp., 39.9°. Specimen decalcified and dubious.

Ten specimens.

### **Molpadia intermedia.**

*Trochostoma intermedium* LUDWIG, 1894. Mem. M. C. Z., Vol. 17, p. 161.

*Molpadia intermedia* H. L. CLARK, 1907 (1908). Apodous Holoth., p. 33.

There is a very good series of this well known molpadid, the young being in the Ankyroderma stage, and having many more, and much more perfectly formed, tables than the adults. The largest specimen is over 100 mm. long, while the smallest is only 33 mm. of which 13 mm. is tail.

Station 5676. Off San Juanico, west coast of Lower California, 647 fms. Bottom Temp., 39°.

Station 5683. Off Cape St. Lucas, Lower California, 630 fms. Bottom Temp., 39.1°.

Station 5688. Off Cedros Island, west coast of Lower California, 525 fms. Bottom Temp., 39.9°.

Station 5689. Off Rosario Bay, west coast of Lower California, 879 fms.

Station 5690. Off Rosario Bay, west coast of Lower California, 1101 fms. Bottom Temp., 38.1°.

Station 5694. Southwest of Santa Cruz Island, California, 640 fms.

Station 5697. Off Monterey County, California, 485 fms. Bottom Temp., 39.8°.

Station 5698. Off Monterey County, California, 475 fms. Bottom Temp., 39.9°.

Bathymetrical range, 475-1101 fms. Temperature range, 39.9°-38.1°.

Twenty-two specimens.

### **Molpadia musculus.**

Risso, 1826, Hist. Nat. Prin. Prod. Europe, Mer., p. 293.

These specimens are small (the largest only 70 mm. long, of which 20 mm. is tail) and two are in very poor condition. These two have minute, scattered phosphatic bodies and some anchors and rosettes, and undoubtedly are the form called by Ludwig, *Ankyroderma spinosum*. In the largest specimen neither phosphatic bodies nor anchors were found.

Station 5684. Southwest from Magdalena Bay, west coast of Lower California, 1760 fms.

Station 5692. Off Pt. San Tomas, west coast of Lower California, 1076 fms. Bottom Temp., 37.1°.

Three specimens.

### ***Caudina californica.***

Ludwig, 1894. Mem. M. C. Z., Vol. 17, p. 155.

These specimens are small, 70 mm. long of which about half is tail, but their identity is unmistakable.

Station 5698. Off Monterey County, California, 475 fms. Bottom Temp., 39.9°.

Station 5699. Southwest from Monterey Bay, California, 659 fms. Bottom temp., 37.9°.

Two specimens.

### ***Cucumaria abyssorum.***

Théel, 1886. "Challenger" Holoth.: Pt. II, p. 66.

This species is represented in the collection by a good series, ranging from 30 to 80 mm. in length, but showing no noteworthy peculiarities.

Station 5673. Off Pt. San Tomas, west coast of Lower California, 1090 fms.

Station 5684. Southwest from Magdalena Bay, west coast of Lower California, 1760 fms.

Station 5691. Off Pt. San Tomas, west coast of Lower California, 868 fms. Bottom Temp., 37.2°.

Station 5692. Off Pt. San Tomas, west coast of Lower California, 1076 fms. Bottom Temp., 37.1°.

Bathymetrical range, 868-1760 fms. Temperature range, 37.2°-37.1°.

Twenty-nine specimens.

### ***Sphærothuria bitentaculata.***

Ludwig, 1894. Mem. M. C. Z., Vol. 17, p. 141.

This remarkable species, so fully described and discussed by Ludwig, is represented by some specimens about 16 mm. long. The shallowness of the water and the high bottom temperature at the spot where they were taken is notable.

Station 5675. Southwest of San Cristobal Bay, west coast of Lower California, 284 fms. Bottom Temp., 44.6°.

Four specimens.

***Psolus squamatus*.**

*Holothuria squamata* O. F. MÜLLER, 1776. Zool. Dan. Prod., p. 232.

*Psolus squamatus* MCANDREW & BARRETT, 1857. Ann. Mag. Nat. Hist. (2) Vol. 20, p. 45.

A large *Psolus*, 88 mm. long, 45 mm. wide and 30 mm. high in its fully contracted condition, seems to belong to this northern species. I have compared it with specimens from Norway and cannot find any satisfactory grounds on which to separate them. Nevertheless I shall not be surprised if abundant material in good condition shows that the Californian *Psolus* is specifically different from the North European species.

Station 5695. Southwest of Santa Rosa Island, California, 534 fms. Bottom Temp., 38.9°.

***Achlyonice ecalcareia*.**

Théel, 1879. Bih. Kongl. Svenska Vet. Akad. Handl., Vol. 5, no. 19, p. 13.

Although the specimens are in poor condition, it is possible to determine their generic position, the number of tentacles being constantly 12 and the arrangement of the pedicels and dorsal papillæ being determinable by comparison of the different individuals. Although there are calcareous rods present in the tentacles, I could find no calcareous ring nor any particles in the body-wall. I think therefore that their absence in Théel's specimens was not due to their dissolution in the alcohol. In any case however, Théel's change of the name to *paradoxa* is of course inadmissible. The best individual before me is only about 60 mm. long and is thus much smaller than the 'Challenger' specimens.

Station 5689. Off Rosario Bay, west coast of Lower California, 879 fms. Five specimens.

***Lætmenæcus*<sup>1</sup> gen. nov.**

Body elongated, more or less cylindrical. Lateral ventral ambulacra with relatively few (15-20) large pedicels; mid-ventral ambulacrum possibly with a few similar pedicels posteriorly. Dorsal ambulacra apparently without appendages. Tentacles 15. Calcareous particles in the body-wall, wheels and rods as in *Lætmogone*.

Type-species.—*Lætmenæcus scolocides* sp. nov.

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<sup>1</sup> λαῖτμα = the deep sea + ἐνοικος = an inhabitant.

***Lætmenæcus scotoeides*<sup>1</sup> sp. nov.**

Body nearly cylindrical, or perhaps somewhat flattened on ventral surface, larger posteriorly than anteriorly, 150–200 mm. long, 25–35 mm. in diameter. Along each side of the body, delimiting the ventral surface, which becomes distinctly narrower posteriorly, is a series of sixteen or seventeen large papilla-like pedicels. There appear to be no other ambulacral appendages anywhere on the body, unless there are a few scattered pedicels along the mid-ventral ambulacrum near the rear of the animal. I was unable to make myself certain on this point nor could I convince myself beyond question that there are no dorsal appendages in the living animal. However I could find no satisfactory evidence of their present or past existence. Body wall thin and soft, but completely full of the calcareous particles; even the longitudinal muscles are full of calcareous rods. Tentacles fifteen, of equal size; the terminal disk is 3–5 mm. across. Anus terminal or slightly dorsal in position. Calcareous ring well developed, very much like that figured by Théel for *Lætmogone wyville-thomsoni*. Polian vessel, single and large. Madreporic openings in back, about 35 mm. from anterior end, not at all conspicuous. No evident genital papilla. Genital glands in two short tufts, one on each side of mesentery, much like those figured by Théel for *Lætmogone*.—Calcareous particles consist of wheels and rods. The former are similar to those of *Lætmogone* and need no detailed description; the small ones are .09 mm. in diameter or less and have ten to thirteen spokes; the large ones are .15–.20 mm. across and commonly have ten spokes. The wheels are chiefly found on the dorsal surface but small ones also occur in the ventral integument. The rods are nearly straight and only slightly roughened bodies, .15–.25 of a millimeter long; they are abundant ventrally but are few and far between dorsally; they are common in the longitudinal muscles.—Color uniform deep purple.

Type.—Cat. No. —, U. S. N. M., from Station 5685.

If the above described specimens had any obvious appendages on the dorsal surface, they would fit well into the genus *Lætmogone*, but there are no such outgrowths, nor is there any evidence to indicate that they were present in life and have been accidentally lost. In one specimen, I found what seemed to be two pedicels in the midventral line posteriorly, but the conditions of preservation prevented my determining the point satisfactorily. Under the circumstances, I cannot place these specimens in *Lætmogone* and so have instituted a new genus for them.

Station 5685. Southwest from Ballenas Bay, west coast of Lower California, 645 fms. Three specimens.

***Lætmophasma fecundum*.**

Ludwig, 1894. Mem. M. C. Z., Vol. 17, p. 85.

These specimens are much smaller than Ludwig's types, measuring only about 85 mm. in length, and I am far from feeling satisfied as to their

<sup>1</sup> σκοτοειδής = dark-looking.



identity. Their condition is so poor, it is not possible to tell the number of tentacles, but on the better preserved one, only thirteen can be counted. The calcareous particles are exactly like those described and figured by Ludwig. The series of pedicels in the mid-ventral ambulacrum is evident but on neither the dorsal nor ventral surface are the ambulacral outgrowths nearly as numerous as in Ludwig's description. It is possible however that this difference is a matter of age, but the genital glands are in two well developed tufts, utterly unlike the elongate organs figured by Ludwig for *Lætmophasma*, and it is more difficult to believe that this is an effect of immaturity. I think it quite probable therefore that these specimens are not *fecundum* and very possibly not *Lætmophasma*, but in view of their condition I am not willing to describe them as a new species.

Station 5688. Off Cedros Island, west coast of Lower California, 525 fms. Bottom Temp., 39.9°. Two specimens.

### **Pannychia moseleyi.**

Théel, 1882. 'Challenger' Holoth.: Pt. I, p. 88.

Although none of the specimens before me is in good condition, several permit a more or less accurate estimate of the number of ambulacral appendages. This estimate shows that these individuals are intermediate between Théel's typical specimens and Ludwig's proposed variety *henrici*, and makes it probable that the latter name does not cover a constant form, and need not be retained. The largest specimen in the present lot is about 160 mm. long and has twenty tentacles.

Station 5676. Off San Juanico, west coast of Lower California, 647 fms. Bottom Temp., 39°.

Station 5685. Southwest from Ballenas Bay, west coast of Lower California, 645 fms.

Nine specimens.

### **Oneirophanta mutabilis.**

Théel, 1879. Bih. Kongl. Svenska Vet. Akad. Handl., Vol. 5, no. 19, p. 6.

There is a single specimen, 125 mm. long, in very good condition, of this widely distributed species.

Station 5684. Southwest from Magdalena Bay, west coast of Lower California, 1760 fms.

**Benthodytes sanguinolenta.**

Théel, 1882. 'Challenger' Holoth.: Pt. I, p. 104.

Although this species was met with at several stations, and special efforts were evidently made to preserve some good specimens, the material is all in poor condition. The individuals range in length from about 60 to nearly 250 mm. Ludwig is undoubtedly correct in saying that the absence of calcareous deposits is not accidental but is the normal condition for the species.

Station 5673. Off Pt. San Tomas, west coast of Lower California, 1090 fms.

Station 5684. Southwest from Magdalena Bay, west coast of Lower California, 1760 fms.

Station 5690. Off Rosario Bay, west coast of Lower California, 1101 fms. Bottom Temp., 38.1°.

Station 5692. Off Pt. San Tomas, west coast of Lower California, 1076 fms. Bottom Temp., 37.1°.

Bathymetrical range, 1076–1760 fms. Temperature range 38.1°–37.1°. Seventeen specimens.

**Pseudostichopus mollis.**

Théel, 1886. 'Challenger' Holoth.: Pt. II, p. 169.

While it is possible that this large series contains more than a single species, the absence of calcareous deposits and of conspicuous ambulacral appendages makes it impracticable to distinguish more than one. Some of the small specimens have the body-wall very thin, but most of the adults have a thick and firm perisome. The largest specimens are 150–160 mm. long. The natural color is creamy white, but more or less fine sand adheres to the skin and in some cases, wholly conceals the ground color.

Station 5689. Off Rosario Bay, west coast of Lower California, 879 fms.

Station 5690. Off Rosario Bay, west coast of Lower California, 1101 fms. Bottom Temp., 38.1°.

Station 5691. Off Pt. San Tomas, west coast of Lower California, 868 fms. Bottom Temp., 37.2°.

Station 5693. Northwest of San Nicolas Island, California, 451 fms.

Station 5695. Southwest of Santa Rosa Island, California, 534 fms. Bottom Temp., 38.9°.

Bathymetrical range, 451–1101 fms. Temperature range 38.9°–37.2°. Forty-eight specimens.

**Stichopus parvimensis**<sup>1</sup> sp. nov.

The specimens of this apparently new species agree with each other remarkably well in all particulars. They are about 200 mm. long but pressure from each other and from other specimens has so distorted them that their appearance in life is not easy to infer. The pedicels are very numerous both dorsally and ventrally, and there is no indication, even on the lower surface, of arrangement in longitudinal series. Along each side of the body are a few (3-6) big tubercle-like papillæ and there is at least one row and probably two of similar papillæ on the back. Judging from other species of the genus, the body in life is more or less quadrangular and there is a series of these big papillæ along each angle. There are twenty tentacles. The calcareous ring is well-developed and not peculiar. The gonads are in large equal tufts, one on each side of the dorsal mesentery. The color is light chestnut-brown, much paler below than above. Most of the pedicels, but not all, are very dark brown, and thus appear in the preserved specimens like small blackish spots.

The really characteristic feature of this species is to be found in the calcareous deposits. Like its previously-known fellow species of the Pacific coast of America, this new form has both "tables" and "buttons" in the body-wall. The buttons are about 90  $\mu$  in length and have three or four pairs of holes. They are not usually very symmetrical and hardly any two are exactly alike. As compared with the buttons of *S. californicus* and *S. johnsoni*, these deposits are very small and have a small number of holes, for in *californicus*, the buttons are 140-165  $\mu$  long and have frequently 10-12 holes, while in *johnsoni*, the buttons are 165-190  $\mu$  in length with 10-16 holes. Similar peculiarities mark the tables; in *parvimensis*, the disk is only about 45  $\mu$  across and rarely has more than four perforations, though occasionally two or three other small ones alternate externally with the primary ones; the crown of the spire has 8-10 teeth and is less than 20  $\mu$  across. In *californicus*, the tables are larger and more variable, the disk measuring from 50 to 90  $\mu$  in diameter and having 8 to 18 perforations, while the spire is crowned with 12 or more teeth and measures about 25  $\mu$  across. In *johnsoni*, the tables are again much larger, 120-170  $\mu$  in diameter with 25-40 holes in the disk and the spire with 20-25 teeth on the crown which is nearly 50  $\mu$  across.

Type.—Cat. No. —, U. S. N. M.

It is curious and a little perplexing that *johnsoni* which is geographically intermediate between the other two species is not so structurally but has the most highly specialized calcareous particles. Of course, it may be that we shall find the three species have broadly overlapping ranges and future study made show that all are forms of a single variable species. But I have compared the specimens of *parvimensis* before me with the type of Théel's species (*johnsoni*) and with specimens of *californicus* from Monterey Bay, California, and from Puget Sound, and I find no reason whatever for not recognizing each as a valid species.

The label with the three specimens of *parvimensis* says they were taken

<sup>1</sup> *parvimensis* = with small tables.

"in sea-weed, in  $3\frac{1}{2}$  ft." near shore on the east side of Cedros Island, west coast of Lower California, March 12, 1911. As the specimens have many fragments of eel-grass attached to them, it is evident that the "sea-weed" referred to is probably eel-grass. Such bottoms are favorite resorts of *Stichopus* in the West Indian region.

### ***Holothuria lubrica.***

Selenka, 1867. Zeits. f. w. Zool., Vol. 17, p. 329.

It is unfortunate that there is no clue to the locality where these specimens were taken, for that might throw some light on the northern limit of this Panamic species. It has not previously been reported from north of Mazatlan. These specimens are all adult and in good condition. Eight specimens.

### ***Holothuria impatiens***

*Fistularia impatiens* FORSKÅL, 1775. Desc. Anim., p. 121.

*Holothuria impatiens* GMELIN, 1788. Linné's Sys. Nat. ed. 13, p. 3142.

With the eight specimens of *lubrica* was a single, small, poorly preserved holothurian which I refer to this species, not because I believe it to be *impatiens* but because it is one of those specimens, with papillæ all over the body and with tables and buttons in the skin, which have hitherto been referred to that East Indian species regardless of whether they came from the east or west side of Mexico and Central America. Were there more specimens and from a definite locality, they would probably serve as the basis for a new species, but as the specimen is poor and the locality unknown, no further comments on it are necessary.

## EXPLANATION OF PLATES.

## PLATE XLIV.

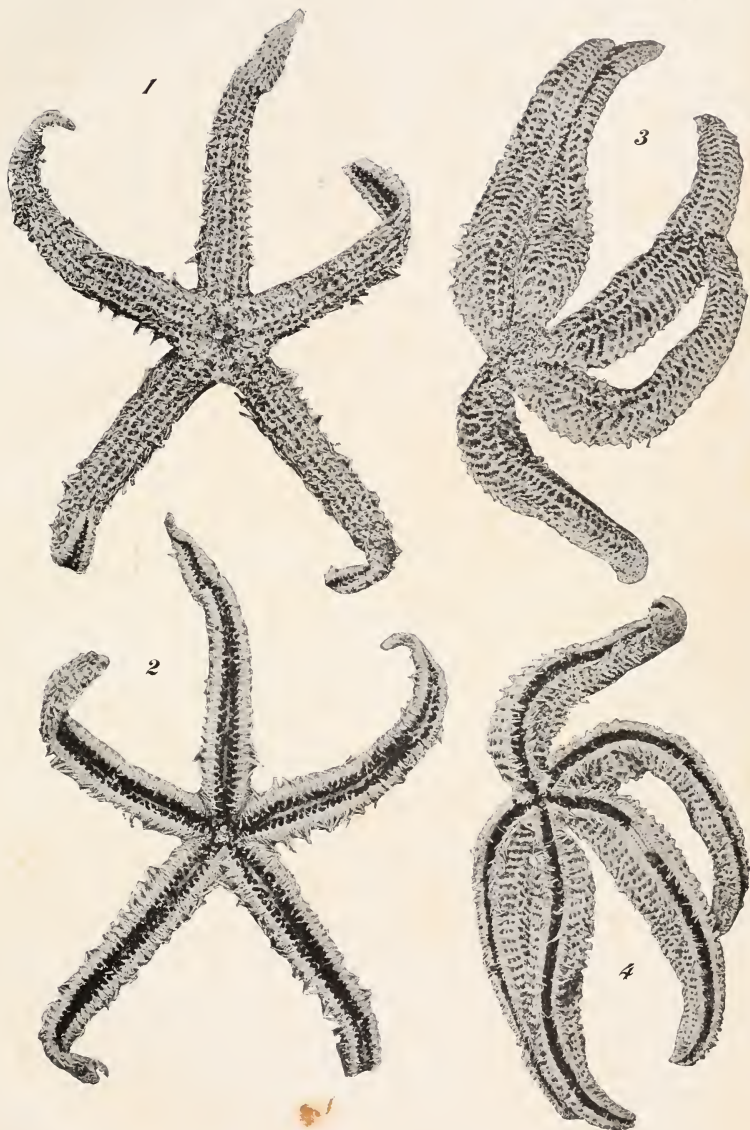
- Fig. 1. *Zoroaster platyacanthus* sp. nov. Holotype (upper view). Nat. size.  
 Fig. 2. " " " (lower view).  
 Fig. 3. *Pedicellaster hyperoncus* sp. nov. Holotype (upper view). Nat. size.  
 Fig. 4. " " " (lower view).

## PLATE XLV.

- Fig. 5. *Diopederma axiologum* sp. nov. Holotype (upper view). Nat. size.  
 Fig. 6. " " " (lower view).  
 Fig. 7. " " " Base of arm and adjoining portion of  
 disc,  $\times 4\frac{1}{2}$ .  
 Fig. 8. *Ophiura oligopora* sp. nov. Holotype (upper view).  $\times 2\frac{1}{2}$ .  
 Fig. 9. " " " (lower view).

## PLATE XLVI.

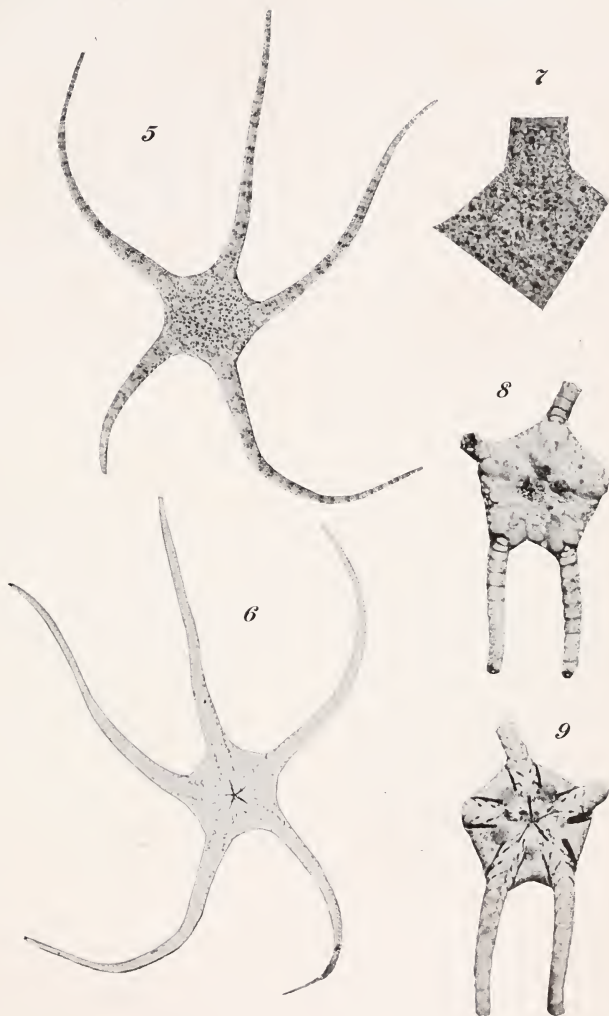
- Fig. 10. *Urechinus reticulatus* sp. nov. Holotype (side view).  $\frac{4}{5}$  nat. size.  
 Fig. 11. " " " (posterior view).  
 Fig. 12. " " " (upper view).  
 Fig. 13. " " " (lower view).



Figs. 1, 2. *Zoroaster platyacanthus* sp. n.  
 " 3, 4. *Pedicellaster hyperonicus* sp. n.







Figs 5-7. *Diopederma axiologum* gen. et. sp. n.  
 " 8, 9. *Ophiura oligopera* sp. nov.



11



10



13



12



*Urechinus reticulatus* sp. n.



(Continued from 4th page of cover.)

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